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THIRTY-SECOND ANNUAL REPORT

OF THE

ILLINOIS STATE BEEKEEPERS' ASSOCIATION

1932

FORTY-SECOND YEAR OF ASSOCIATION

Organized February 26, 1891, at
Springfield, Illinois

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Compiled by
E. J. McCORMICK
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Chicago, Illinois

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LETTER OF TRANSMITTAL.

OFFICE OF THE SECRETARY,
CHICAGO, ILLINOIS, *December 31, 1932.*

To His Excellency, Henry Horner, Governor of the State of Illinois:

SIR: I have the honor to transmit herewith the Thirty-second Annual Report for the forty-second year of the Illinois State Beekeepers' Association.

E. J. MCCORMICK, *Secretary.*

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THIRTY-SECOND ANNUAL REPORT

FOR THE FORTY-SECOND YEAR

OF THE

Illinois State Beekeepers' Association

OFFICERS OF ILLINOIS STATE BEEKEEPERS' ASSOCIATION FOR 1932.

C. A. MACKELDEN - - - - - - President
Jerseyville.

LOUIE VANNIS - - - - - - Vice-President
Harrisburg.

J. N. KORITZ - - - - - - Vice-President
Buckley.

BENJ. H. FISCHER - - - - - Vice-President
Roanoke.

A. G. GILL - - - - - - Vice-President
Chicago.

S. F. PETERSON - - - - - - Vice-President
East Moline.

ELMER KOMMER - - - - - - Treasurer
Woodhull.

V. G. MILUM - - - - - - - Secretary
Vivarium Building, Champaign.

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EDWIN PETERSON - - - - - - Vice-President
Kewanee.

LOUIE VANNIS - - - - - - - Vice-President
Harrisburg.

ROY ANNEAR - - - - - - - Vice-President
Mulkeytown.

BENJ. H. FISCHER - - - - - - Vice-President
Roanoke.

A. G. GILL - - - - - - - - Vice-President
Chicago.

ELMER KOMMER - - - - - - - Treasurer
Woodhull.

E. J. MCCORMICK - - - - - - - Secretary
6810 South Winchester Avenue, Chicago.

MINUTES OF THE FORTY-SECOND ANNUAL CONVENTION OF THE ILLINOIS STATE BEEKEEPERS' ASSOCIATION, SPRINGFIELD, ILLINOIS, NOVEMBER 15–16, 1932.

The forty-second annual convention of the Illinois State Beekeepers' Association, held in the parlors of the State Nicholas Hotel, Springfield, Illinois, was called to order at 11:30 a. m., November 15, by the President, C. A. Mackelden, of Jerseyville. The minutes of the last meeting were read and approved.

The following committees were appointed by Mr. Mackelden: Auditing—B. F. Bell, Kingston Mines, and Edwin Peterson, Kewanee; Resolutions—W. W. Osborn, Hillsboro, and Lawrence Fisher, Woodson; Banquet—Harry Luer, Jerseyville, and Emory Warner, Monticello.

The financial reports of the treasurer and secretary were read by Elmer Kommer and V. G. Milum, respectively, and referred to the Auditing Committee, who at the final business session on the morning of November 16, reported them correct and on motion of Mr. Bell, seconded by Mr. Kildow, the reports were accepted by unanimous vote.

These reports showed total receipts during the year beginning November 17, 1931, and ending November 15, 1932, of $458.37 and total expenditures of $316.09 leaving a balance on hand November 15, 1932, of $142.28.

The morning session of November 15 adjourned at 12:15 p. m. and the meeting was again called to order at 1:45 p. m. with President Mackelden presiding.

Dr. R. C. J. Meyers who was to have spoken on the subject, "The Use of Honey in Health and Disease" was unable to be present. On motion, the reading of the paper was deferred to the end of the program.

Mr. Virgil Rocke of Eureka discussed his experiences in judging at the State Fair, explaining the methods followed. This brought up considerable discussion with the result that President Mackelden called a special conference to convene after the banquet to consider revisions to the rules and premium lists of the apiary exhibit at the State Fair.

Mr. C. L. Duax of Chicago discussed "Bees and the Depression" and Edwin Peterson of Kewanee, "What is the Future in Beekeeping?" Both of these topics invoked considerable discussion.

The annual banquet of the association was held in the convention parlors at 6:30 on the evening of November 15. Special guests of the association were Mr. Stuart E. Pierson, Director of Agriculture, Assemblyman William H. Jackson of Toulon and Senator Harry Wilson of Pinckneyville. Mr. Stanley Smith of the State Publicity Department, and Miss Ethel VanGilder, Superintendent of the Culinary Department, Illinois State Fair. Each of these responded with brief

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EDWIN PETERSON - - - - - - Vice-President
Kewanee.

LOUIE VANNIS - - - - - - - Vice-President
Harrisburg.

ROY ANNEAR - - - - - - - Vice-President
Mulkeytown.

BENJ. H. FISCHER - - - - - - Vice-President
Roanoke.

A. G. GILL - - - - - - - - Vice-President
Chicago.

ELMER KOMMER - - - - - - - Treasurer
Woodhull.

E. J. MCCORMICK - - - - - - - Secretary
6810 South Winchester Avenue, Chicago.

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addresses when presented by the toastmaster. Special entertainment for the banqueters was furnished by Nola and Ivan Annear of Mulkeytown and Mr. and Mrs. C. L. Duax of Chicago. (You can hear Mr. Duax as "Bob White" over the radio from Station WLS on noon-day and "Barn Dance" programs.)

The final meeting on November 16 was called to order at 9:15 by the President, C. A. Mackelden.

The Auditing Committee reported as previously stated, followed by a report of the Resolutions Committee. The resolutions appearing in another part of this report were read by Mr. Osborn and motion of Mr. Osborn, seconded by Edwin Kommer, were adopted by unanimous vote.

Telegrams from the Joliet Convention Bureau and the California State Beekeepers' Association were read and on motion of Mrs. Winkler, duly seconded, the secretary was instructed to send replies.

The next order of business was the election of officers which resulted in the election of C. A. Mackelden of Jerseyville as President; Vice-Presidents, Louie Vannis, Harrisburg; Ben Fischer, Roanoke; A. G. Gill, Chicago; Edwin Peterson, Kewanee; Roy Annear, Mulkeytown; Treasurer, Elmer Kommer, Woodhull, and Secretary, E. J. McCormick, Chicago. Votes of appreciation were extended to the president, treasurer and secretary for their work of the year in behalf of the Association.

The remainder of the session was spent in a discussion of plans for the advertising Illinois honey, a general tax on bees, and city laws against keeping bees.

President Mackelden announced the personnel of a legislative commitee as follows:

Mrs. Vera Winkler, Joliet; Adam Bodenschatz, Lemont, and Harry Luer, Jerseyville.

The meeting was adjourned at 11:45 a. m., November 16, 1932.

RESOLUTIONS APPROVED AND ADOPTED AT THE FORTY-SECOND ANNUAL CONVENTION HELD NOVEMBER 15–16, 1932.

Be it resolved, That the Illinois State Beekeepers' Association in its forty-second annual convention assembled at Springfield, Illinois, November 15th and 16th, 1932, does hereby approve and adopt the following resolutions, and

Be it further resolved, That a copy of same be spread upon the minutes and copies sent to the various parties concerned:

1. *Be it resolved,* That a vote of thanks be extended to the State Agricultural Department, especially to the State Fair Division, and Miss Ethel VanGilder, Superintendent of the Culinary Department, for their continued cooperation in promoting the use of honey through the inclusion of honey items in the premium list.

2. *Be it resolved,* That a vote of thanks be extended to the management of the St. Nicholas Hotel, through whose courtesy we are permitted the use of their parlors and other facilities.

3. *Be it resolved,* That a very cordial vote of thanks be extended to all those who have taken part in our meeting, contributing their time and efforts to make it a success.

4. *Be it resolved,* That our association commends our apiary inspector Mr. A. L. Kildow, for his efficient and able conduct of the duties of his office, and

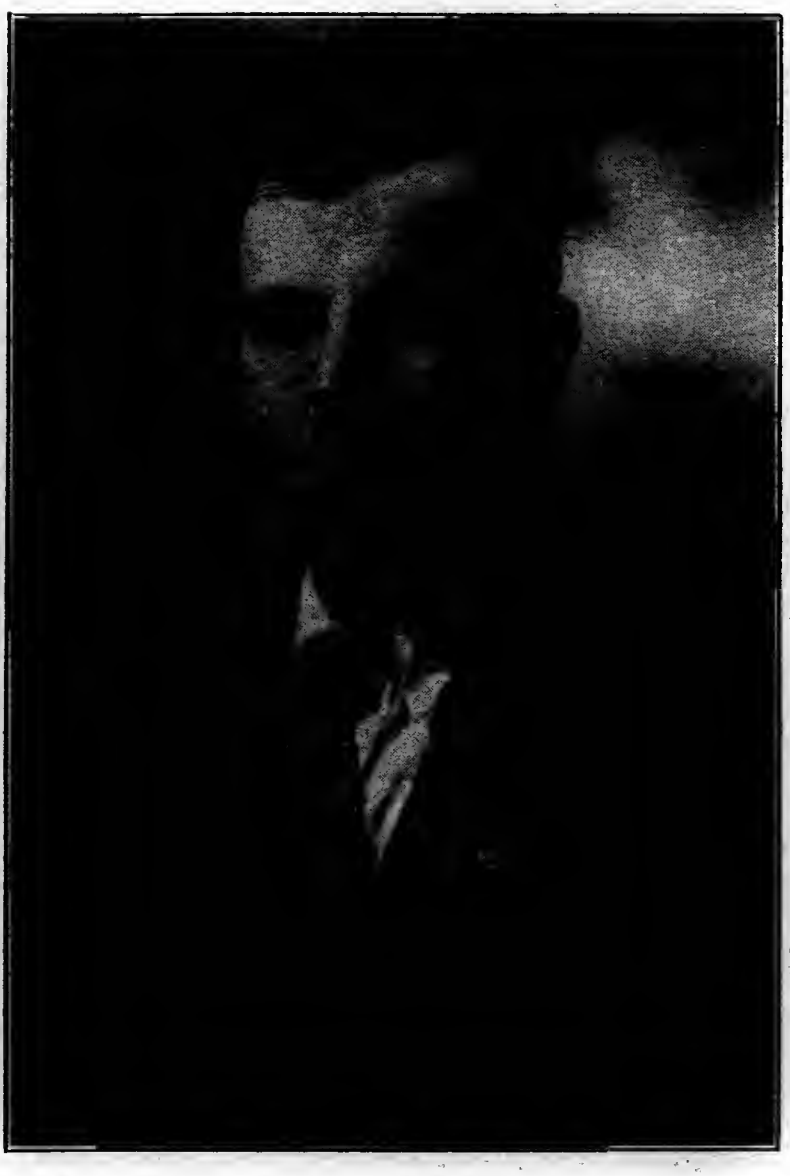
Be it further resolved, That a copy of this resolution be placed before the incoming Governor, Hon. Henry Horner, when he shall take his seat at Springfield.

5. *Be it resolved,* That we heartily approve of the American Honey Institute and its activities in advancing the use of honey and recommend that all our members do their part in supporting this institution which is working in the interests of us all.

6. *Be it resolved,* That we suggest full cooperation with all companies and organizations who feature honey in their products.

7. *Be it resolved,* That we recognize our loss in the departure of those members called to their eternal reward since our last meeting, and extend our sincere sympathy to their families.

WESLEY W. OSBORN,
LAWRENCE FISHER,
Resolutions Committee.



MR. ELMER KOMMER, WOODHULL, ILLINOIS.
Treasurer of Illinois State Beekeepers' Association.

REPORT OF THE TREASURER FOR 1932.

WOODHULL, ILLINOIS, *November 15, 1932.*

To the Illinois State Beekeepers' Association—Greetings:

The following is my seventh annual report as Treasurer of the Illinois State Beekeepers' Association, subject to your approval:

RECEIPTS.

No.		
	Balance on hand at last convention	$191.60
(1)	December 10, 1931—From V. G. Milum, Secretary	29.00
(2)	January 11—From V. G. Milum, Secretary	16.50
(3)	February 12—From V. G. Milum, Secretary	31.00
(4)	April 7, 1932—From V. G. Milum, Secretary	31.50
(5)	June, 1932—A. S. Hamilton, Receiver, 5 per cent dividend	15.77
(6)	June 13—From V. G. Milum, Secretary	13.50
(7)	July 23—From V. G. Milum, Secretary	43.00
(8)	September 5—From V. G. Milum, Secretary	28.00
(9)	October 3—From members joining at State Fair	5.00
(10)	October 27—From V. G. Milum, Secretary	36.00
(11)	November 15—From V. G. Milum, Secretary	17.50
	Total receipts	$458.38

EXPENDITURES.

Voucher No.		
(1)	November 20—V. G. Milum, expense to annual convention	$30.00
(2)	November 20—Elmer Kommer, expense to annual convention	17.86
(3)	November 30—C. A. Mackelden, expense to annual convention	17.50
(4)	January 4—American Honey Producers' League, affiliation fee	12.00
(5)	January 20—V. G. Milum, expense to executives meeting	8.57
(6)	February 8—Elmer Kommer, expense to executives meeting	15.16
(7)	February 8—V. G. Milum, salary, 3 months	50.00
(8)	February 15—American Honey Institute (donation)	15.00
(9)	June 8—V. G. Milum, salary, 3 months	50.00
(10)	August 27—V. G. Milum, salary, 3 months	50.00
(11)	August 30—American Honey Institute, $30.00 not paid as association finances would not warrant the payment on any further donations to institute.	
(12)	November 8—V. G. Milum, salary in full for year	50.00
	Total expenditures	$316.09

RECAPITULATION.

Total receipts	$458.37
Total expenditures	316.09
Balance	$142.28

I have the funds in my possession as follows:

Postal money order	$100.00
Checking account, Farmers' National Bank, Cambridge	24.78
Check from V. G. Milum	17.50
	$142.28

(Signed) ELMER KOMMER,
Treasurer, Illinois State Beekeepers' Association.

November 15, 1932.

We, the Auditing Committee have examined these records and have found them correct.

(Signed) E. F. PETERSON,
B. F. BELL,
Auditing Committee.

FINANCIAL REPORT OF THE SECRETARY FOR PERIOD BEGINNING NOVEMBER 17, 1931 AND ENDING NOVEMBER 15, 1932.

RECEIPTS.

Balance in treasury at last convention, November 17, 1931..... $191.60

Received by Secretary and transmitted to Treasurer or received by Treasurer direct according to the following Membership Dues Receipt Numbers:

Receipt number.	Date received by treasurer.	Description.	Amount received by secretary.	Remitted for Bee Journals.	Remitted to treasurer.
No. 1	Dec. 10	Cook-DuPage Assn	$2.00		
		Morgan-Scott Assn	.50		
		Woodford Co. Assn	.50		
		Members at large	31.50	$5.50	
			$34.50	$5.50	$29.00
No. 2	Jan. 11	Fulton Co. Assn	$1.50		
		Morgan-Scott Assn	2.00		
		Stephenson Co. Assn	5.00		
		JoDaviess Co. Assn	2.00		
		Members at large	7.50	1.50	
			$18.00	$1.50	$16.50
No. 3	Feb. 12	Peoria Co. Assn	$4.00		
		JoDaviess Co. Assn	3.00		
		Warren Co. Assn	5.00		
		Mercer Co. Assn	4.50		
		DeKalb Co. Assn	7.00		
		Jersey Co. Assn	.50		
		Members at large	7.50	$ .50	
			$31.50	$ .50	$31.00
No. 4	Apr. 7	Saline-Gallatin Assn	$2.50		
		DeKalb Co. Assn	4.00		
		Ford Co. Assn	2.00		
		Peoria Co. Assn	1.00		
		Woodford Co. Assn	1.00		
		Henry Co. Assn	8.00		
		Lake-McHenry Co. Assn	1.00		
		Jersey Co. Assn	.50		
		Piatt Co. Assn	3.00		
		Mercer Co. Assn	.50		
		Cook-DuPage Assn	7.00		
		Members at large	1.00		
			$31.50		$31.50
No. 5	May 13	5% dividend on $315.38	($15.77 to treas.)		$15.77
No. 6	June 13	Henry Co. Assn	3.50		
		Woodford Co. Assn	1.00		
		Saline-Gallatin Assn	2.00		
		Fulton Co. Assn	3.00		
		Iroquois Co. Assn	2.00		
		Members at large	2.50	$ .50	
			$14.00	$ .50	$13.50
No. 7	July 23	Lake-McHenry Co. Assn	$27.00		
		Henry Co. Assn	2.00		
		Woodford Co. Assn	2.00		
		Morgan-Scott Co. Assn	2.50		
		Champaign Co. Assn	3.50		
		Saline-Gallatin Co. Assn	1.00		
		Fulton County Assn	1.00		
		Members at large	4.00		
			$43.00		$43.00

MR. V. G. MILUM, VIVARIUM, BLDG., CHAMPAIGN, ILLINOIS.
Secretary of Illinois State Beekeepers' Association.

RECEIPTS—(Concluded).

Receipt number.	Date received by treasurer.	Description.	Amount received by secretary.	Remitted for Bee Journals.	Remitted to treasurer.
No. 8	Sept. 5	Macon Co. Assn	$15.00		
		Morgan-Scott Co. Assn	.50		
		Cook-DuPage Co. Assn	9.50		
		Members at large	3.00		
			$28.00		$28.00
No. 9	Oct. 3	Members at large	$5.00		$5.00
No. 10	Oct. 27	McHenry-Lake Co. Assn	$4.50		
		Shelby Co. Assn	5.00		
		Montgomery Co. Assn	7.00		
		Northwestern-Ind. Assn	2.50		
		Saline-Gallatin Co. Assn	1.00		
		DeKalb Co. Assn	4.00		
		Henry Co. Assn	1.00		
		JoDaviess Co. Assn	2.00		
		Cook-DuPage Co. Assn	5.00		
		Tri-County Assn	4.00		
			$36.00		$36.00
No. 11	Nov. 15	Stephenson Co. Assn	$5.00		
		Will County Assn	6.50		
		Morgan-Scott Co. Assn	1.50		
		Champaign Co. Assn	.50		
		Members at large	4.50	$ .50	
			$18.00	$ .50	$17.50
			$275.27	$8.50	$266.77

Totals received by Secretary and Treasurer	$275.27
Remitted by Secretary for Bee Journals	8.50
Total received or remitted to Treasurer	$266.77
Balance on hand November 17, 1931	191.60
Total receipts for year ending November 16, 1932	$458.37

EXPENDITURES.

From November 17, 1931, to November 15, 1932, by vouchers as follows:

No. 1—November 20, 1931—V. G. Milum, expenses to 1931 annual convention and banquet tickets	$ 30.00
No. 2—November 23, 1931—Elmer Kommer, expenses to 1931 annual convention	17.86
No. 3—November 30, 1931—C. A. Mackelden, expenses to 1931 annual convention	17.50
No. 4—January 4, 1932—American Honey Producers' League for 1932 affiliation fee	12.00
No. 5—January 20, 1932—V. G. Milum, expenses to executive committee meeting, Springfield, January 18	8.57
No. 6—February 8, 1932—Elmer Kommer, expenses to executive committee meeting, Springfield, January 18, 1932	15.16
No. 7—February 8, 1932—V. G. Milum, three months salary	50.00
No. 8—February 15, 1932—American Honey Institute, State Association contribution for first quarter of 1932	15.00
No. 9—June 8, 1932—V. G. Milum, three months salary	50.00
No. 10—August 27, 1932—V. G. Milum, three months salary	50.00
No. 11—August 30, 1932—American Honey Institute, State Association contribution for second and third quarters of 1932 ($30.00)—(Voucher disapproved).	
No. 12—November 8, 1932—V. G. Milum, three months salary	50.00

RECAPITULATION.

Total receipts, November 17, 1931, to November 15, 1932	$458.37
Total expenditures, November 17, 1931, to November 15, 1932	316.09
Balance on hand November 15, 1932	$142.28

(Signed) V. G. MILUM,
Secretary, Illinois State Beekeepers' Association.

November 15, 1932.

Upon examination and checking of the accounts we are glad to state that we find them correct and to all appearances correct.

(Signed) B. F. BELL,
E. F. PETERSON,
Auditing Committee.

REGISTERED ATTENDANCE AT 42ND MEETING OF THE ILLINOIS STATE BEE-KEEPERS' ASSOCIATION AT SPRINGFIELD, ILLINOIS, NOVEMBER 15-16, 1932.

Name of beskeeper.	Address.	County.	Number of colonies.	Comb or extracted honey.
R. E. Rankin	Payson	Adams	11	7.
J. Dineen	1251 W. Washington, Springfield	Sangamon	8	
Lawrence W. Fisher	Woodson		60	Extracted.
A. L. Kildow	Putnam	Putnam	210	Both.
J. R. Wooldridge	Chicago	Cook	100	Both.
Benj. H. Fisher	Roanoke	Woodford	50	Both.
Hoyt Taylor	Pleasant Plains	Sangamon	10	Both.
William Osburn	Morris			
Adam Bodenschutz	610 Porter St., Lemont	Cook	180	Both.
Mrs. Adam Bodenschutz	610 Porter St., Lemont	Cook		
Wm. Bigel	R. R. 3, Barrington	Cook	110	Extracted.
C. J. Anderson	Morris	Grundy	175	Extracted.
Lawrence Peterson	Kewanee	Henry	250	
C. W. Brown	Monticello	Piatt	23	Both.
Harry L. King	Springfield	Sangamon	10	Both.
B. F. Bell	Kingston Mines	Peoria	331	Both.
George Schwinn	Pekin	Tazewell	4	Extracted.
J. D. Zook	LaGrange		20	Comb.
Mrs. A. L. Kildow	Putnam	Putnam		
Mrs. B. F. Bell	Kingston Mines			
Emory Warner	Monticello		100	Both.
Gun Mozee	1067 Dakin St., Chicago	Cook	12	Extracted.
Ross Morrill	Geneva	Kane	251	Both.
E. F. Peterson	Kewanee			
Mrs. Hoyt Taylor	Pleasant Plaines			
Mr. H. A. Luer	Jerseyville	Jersey		Both.
Mrs. H. A. Luer	Jerseyville	Jersey		Both.
Miss Helen Rea	Woodson	Morgan	1	
Archie V. Utt	Oak Lawn	Cook	40	Both.
C. L. Duax	Chicago	Cook	360	Both.
Mrs. C. L. Duax	Chicago	Cook	1	
A. C. Gill	Chicago		1	Comb.
H. C. Braun	Williamsville	Sangamon	25	Comb.
W. W. Osburn	Hillsboro	Montgomery	11	Extracted.
S. A. Tyler	San Jose	Logan	300	Both.
Eleanor Nelson Simmer	Chicago		15	Both.
Vera Winkler	Joliet	Will	500	Both.
Mr. F. Hoffmann	Riverside	Cook		
Mrs. F. Hofmann	Riverside	Cook		
Arline Burdorf	Riverside	Cook		
C. A. Mackelden	Jerseyville	Jersey		
Mrs. C. A. Mackelden	Jerseyville	Jersey		
E. J. McCormick	Chicago	Cook	8	Extracted.
V. G. Milum	Champaign	Champaign		
Elmer Kommer	Woodhull	Henry		

THE BEEKEEPERS' PLIGHT.

C. A. MACKELDEN.

Within his honey room bright
The beekeeper often stands,
With threadbare coat, re-seated pants,
And thin and bony hands;
The bottles on his shelves arranged
With gilded honey bands.

With hungry eyes and famished look,
He gazeth to'ard the door,
Longing for another customer,
Who will increase his store
Of money in his money-drawer
At least one dollar more.

His hair is thin, and gray, and short;
His face is pinched and wan;
Thought sits enthroned upon his brow;
He sells what'er he can,
And stares the whole world in the face,
For he is a hard up man.

Week in, week out, from morn till night,
You see him working there,
You hear him sigh his heavy sighs,
The measures of despair;
Lack-lustre eye and shrunken form,
Each tell of want and care.

The children going home from school,
Troop past the open door,
They like to beg for honey
And bee literature galore;
And make life for the beekeeper
One long continual bore.

On Sunday he ne'er goes to church,
His honey sales he must attend;
He never hears a sermon, or
Thinks of his latter end;
From honey room to meals
His footsteps always tend.

Toiling, suffering, sorrowing,
Onward thru' life he goes,
Each morning the same old grind,
Each evening increasing woes,
Till finally he slips off his perch
And takes his long repose.

MODERNIZING THE HONEY APPEAL.*

(By M. G. Dadant.)

Honey has been an article of food since the days of antiquity. Not only was it used as a food in early days, but the bees were revered as having almost supernatural power. Honey was used as a general article in barter, it was carried along on expeditions such as the crusades for a concentrated sweet.

In fact, it supplied probably 98 per cent of the sweets of those early days. From that time, which would have been a bonanza to the beekeeper, we have come down to the present day where honey probably supplies less than 1 per cent of the sweets consumed every year.

Why has honey been crowded off of these markets and what can we do to get it back again?

No Orderly Production.

The beekeepers are a good deal like the sorghum makers when it comes to production. They have no orderly production. We most of us start in beekeeping because we like honey ourselves, and because we like to play with the bees. I start in with bees at Hamilton, you start some place else. One year we may all have good crops, we have lots of honey to sell, the market is glutted, we sell at reduced prices to get rid of it. We, most of us, feel that it must all move out during the fall months.

Then we jumble our production from the very nature of things. I produce a good crop of dark fall honey, all of yours is fine sweet clover. And your neighbor may have some honey dew mixed in. Some of us realize that a standard quality is necessary and hold our poorer grades off the market. But many do not, and we are confronted with a production unregulated which throws all sorts of honey on a market which is used to uniformity in other groceries it buys. Why has country butter dropped in production, and almost given complete way to the creamery product? Most of us like good country butter. But the production on much was inferior; your wife and mine soon decided that they must have uniformity, something we can always count on to be good and we go to the creamery butter.

So much for production. We beekeepers have really been dabbling along, while the sugar, corn syrup and even the maple syrup people have got their production into some stable order. I don't know that there is anything we can do about it, unless we could convince some millionaire that here is a product that should be exploited. I think that some

* Article prepared for Annual Meeting of Illinois State Beekeepers' Association at Springfield, Illinois, November 15-16, 1932.

nationally supervised and advertised honey could do a lot to remedy our ills.

Consumption.

But in a time when we are getting at least 20 per cent of wartime high for our honey, whereas many farm products are selling at 10 per cent or less of the same high, is no time to be discouraged. All we can do is to study our problems, use our best efforts to sell our products, reduce our cost of production, increase our advertising, learn our market, and go after it.

I have been much interested in a bulletin which was recently gotten out by a Mr. M. P. Rasmussen of Cornell University. Like many of our official publications, it waited nearly five years to come out, and so is not of the help it might have been had it come out immediately following the work of Mr. Rasmussen. Rasmussen's work was one of investigation of honey markets, and how they were supplied. If you haven't seen the bulletin you should send for Bulletin No. 221 of the Cornell Extension Department "Production and Marketing of Honey."

He contacted consumers first. He wanted to find out just how many people liked honey. In all his interviews, he found that 87 per cent of the people liked honey and that over 90 per cent of the children liked it. I wonder how many other food products you could say the same thing about.

Then he asked why they did not use honey, and here were the replies in order:

First, it was too high in price; Second, its quality and flavor was uneven, never sure of what you were going to get; Third, they liked sugar or candies better, more handy, etc.; Fourth, honey was never called to their attention, while other sweets were.

Next he tried to find out how the 2-pound per capita of honey was used, and here is what he found:

87% used as a spread;
5% as a medicine;
3% in baking;
4% in cooking;
1% as a beverage.

Mr. Rasmussen knew that a lot of honey went into other channels, so he contacted the bakers, the grocer, etc., to see where the rest of the honey went and why people could not get it when they wanted it.

In 1927, 77 per cent of the bakers used no honey. I imagine with the contacts made by the American Honey Institute, we could find a lot more of them using it now. And 92 per cent of the bakers wanted standardization. They wanted a honey that they could put into their mix and be sure of how it would act. The largest demand for cooking honey was in New York City. Evidently on account of the many foreign born there who are used to it from their days in Europe.

Distribution.

And now let us turn to the distribution of honey. Mr. Rasmussen again tells us that only one-third or less of the grocery stores handle honey at all, and that the bulk of the sales in these is made in a small

number of stores. In other words, you will find one store that specializes in honey where there are ten that just simply have it, but do nothing about it.

And some of the objections on the part of these small distribution stores are that honey is a slow turnover, and that the chains make specials out of it, that it turns to sugar, and that no two jars have the same taste. Here we have again, the same objection as was made by the consumer, and by the baker, lack of uniformity, lack of adequate grading.

In connection with the chain stores, as compared to the independent retail stores, they handle relatively more honey than the independents, per store handling.

Mr. Rasmussen found that the hotels used very little honey. There were a few which used in large quantities. Most of them had it on hand at fabulous prices. Quite a contrast to maple syrup or corn syrup, where purchases were made in large quantities.

A significant thing found was that the most prolific place for good sales of honey was in the public markets and market stalls, where the percentage of honey sold was very large per stall. It makes me wonder if we are not losing a good bet by not pushing harder for sales to all sorts of public marketing places like roadside stands, market stalls, delicatessens, fruit stands, etc.

Merchandising Honey Appeal.

Now that we have considered Production and Consumption of the honey, comes the most important part of all, the Distribution of the honey, or the connecting link between the producer and the consumer, and right here is where I believe, most of the difficulty is with our present day merchandising methods. The world would not be so bad off today if we could distribute all our farm products to those who are actually suffering for something to eat. And honey seems always to have suffered in distribution, good times or bad.

If we are going to distribute our honey, the finest way would be to produce and then turn all over to the jobber and let him dispose of it. A large packer would no doubt do a much better job than we individually could do. The difficulty is to find a packer or jobber, who can do the merchandising on a grand enough scale to dispose of all our honey, and at the same time make a good profit for himself. There doesn't seem to be any such animal. It looks like, then, we should feed the larger markets all they will take comfortably of the honey we have and then bestir ourselves to sell the rest by other means, or at least until some national selling organization does develop which can do the job satisfactorily.

In going direct, we can appeal to the stores, the bakers, candy-makers, roadside stand operators, or direct to the consuming public ourselves.

At any rate whatever avenue we choose, we are either going to have to take into consideration an advertising cost, or else we are going to have to be satisfied with a smaller return. The best advertising agencies will tell you that the average advertising appropriation should be at

least 5 per cent of the cost of the article, and in many instances it runs 50 per cent or more.

And do you know that among beekeepers, 75 per cent do no advertising at all, and of the other 25 per cent, probably not over 5 per cent do the average amount of 5 per cent of sales. How can we expect to get anywhere with our sales unless we spend somewhere near what the other food products spend to keep their product before the public?

I know it's pretty hard for the individual to get out his own advertising but he can put placards in stores, put up road signs, pass out honey leaflets, make honey displays, offer prizes. A novel one just tried, is the observation hive in the store window with a number of prizes offered on the nearest guess to the number of bees in the hive. He can also advertise in the local papers, write articles for the press, exhibit at fairs or make an appeal over the radio. All of these are direct appeal. Or in case he is so situated as to be unable to do these, he can advertise by having the American Honey Institute do it indirectly for him.

You are all well familiar with the American Honey Institute and its wonderful work. I think that this has done more than any one agency ever has done to popularize honey in this country. Its contacts have been so wide and so much to the point in helping honey sales.

1. Bakers and Bakers' Schools
2. Cooking and Demonstration Schools
3. Home Economics Teachers
4. Specialized departments in Large Food Concerns
   - Washburn Crosby
   - Kelloggs
   - Kraft Cheese
   - Universal Range
   - Sunkist Oranges
   - Dozens of others
5. Food Departments of Newspapers and Magazines
6. Articles in Magazines and Newspapers
7. Medical and other agencies

The Institute even tries to help as much to keep the cost down by accepting honey instead of money at the rate proposed of 20 pounds to the ton, which is a 1 per cent advertising fund instead of the orthodox 5 per cent.

But let us assume that our advertising has been done.

We still have the product to place on the market.

Naturally, we should have it properly clarified if extracted honey, and properly graded in either case. I think we are going to see the U. S. grades used more in the next ten years than in the past ten if we are ever going to put honey on the basis the groceryman, the baker and the consumer wants.

And our honey must be properly packed. I know that the sixty pound cans, the ten and five pound cans sell most of the honey, but we have a big market that we must still open up, and we can open it by that eye appeal to the new customer that he can't reach with a plain five pound can, either unlabeled or poorly labeled.

To answer the special eye appeal, of course we have the little individual 2-ounce and 3-ounce jars for hotel and railroad use and the larger glass jars including the 8-ounce, 16-ounce and 32-ounce jars with the intermediary sizes. As come into use, a number of fancy jars like the "Beehive jar" has been recently gotten out so that our extracted honey has come packed in many special packages for the trade. We have, however, very few efforts made to sell a really high priced honey just similar to Egyptian, Hymettus, Grecian, Cuban and other honeys as are sold in some of the delicatessen stores where they get an unusually high price for the special jar, without much regard to the quality of the contents of the honey, except perhaps, that they are imported from these different sections.

A new method which has considerable added promise is the recent effort to pack honey in little tubes like the ordinary tooth paste for shaving cream tubes. These are put out by a firm in Pennsylvania. At first thought, one would not consider this very much of an item but the writer got a few of these tubes and distributed to friends on picnics and the response was almost immediate. Naturally under present conditions, these tubes would not sell because they command higher prices, but under the ordinary conditions, undoubtedly there would quite a market here.

We, of course, also are entering into the modernizing of our comb honey by packing either in cellophane wrapped packages or in cellophane window cartons. The individual "Honey Hunks" and cut comb-honey wrapped in cellophane opens a possible market for additional comb honey. As a matter of fact, I wonder if the pendulum did not swing too far when many beekeepers went from comb honey to extracted. This year comb honey seems to be selling more readily than extracted honey and undoubtedly the pendulum will swing back and many people will go back to comb honey particularly to the bulk comb, possibly because of the effect it may have on an assistance in disease eradication for them.

To my mind, however, the greatest appeal we can have to our potential customers is along the line suggested by the American Honey Institute. Some new items appearing within the past year show very great promise.

The writer recently had opportunity of inspecting some samples of different products put up by the Sisters of St. Benedict at Crookston, Minnesota, who run their own apiaries. They had samples of "Honey Cream," "Honey Fruit Spread" and a number of other articles in addition to their regular liquid honey.

These Sisters are not only practicing beekeeping, but are showing what can be done with the uses of honey. Their schools and convents when they started handling bees were using only about one-half pound per capita whereas the use of honey now extends through all of the different channels and runs in the neighborhood of 92 pounds per capita for the entire enrollment. This is undoubtedly due to the fact that they have placed honey in many of the channels where they did not use it previously. For instance, in the products mentioned above and in their cookery, etc.

The University of Illinois recently perfected the "Honey Cream." This has not as yet been adopted by many of the larger milk and butter distributors but it opened an avenue which should be followed up both by the beekeeper and by the American Honey Institute.

You recently probably have heard over the radio the advertisements for "Honey Butter" as put out by a prominent firm in Chicago. Not only are they advertising on the radio but through the large Chicago daily papers. They claim an article which will keep better than butter, which stands up absolutely perfectly like butter and which has the very high qualities of both butter and honey without any deterioration of either. Here another avenue is opened up for a large distribution.

To my mind, we are missing our greatest opportunities if we do not endow the American Honey Institute so that it can effectively work through all of these organizations and push for these allied products which use honey in part and thus expand the appeal to the consuming public for honey.

These comparatively new uses as far as we are concerned, including the use of honey in candy, cakes, baking, etc., are old uses in the foreign countries. The writer remembers a large number of samples of different honey products sent to us a few years ago which included honey in cough drops and perhaps thirty or forty different sorts of candies, ginger breads, etc., put out by one firm. If we can approach it in this country, no doubt we will find an avenue for our honey production without any serious difficulty.

What we need to do is to modernize the honey appeal.

THE USE OF HONEY IN HEALTH AND DISEASE.*

(By Dr. R. C. J. Meyers, Hillsdale, Illinois.)

Honey is a natural sweet made by the honey bee from nectar gathered by the honey bee from plants and trees. The nectar is gathered and placed within the honey sack and carried to the hive and there placed in the comb by the bees. As this nectar passes thru the mouth and oesophagus of the bee, it comes in contact with saliva and invetase which starts the inversion of nectar into honey that is completed in the comb. With a proper evaporation of the excess moisture, the nectar is ripened into honey and the combs, capped and sealed. It is now ready for use. Nectar is more than a sugar syrup or solution however, as it contains other substances such as enzymes and invertase produced in considerable quantities by the honey bee and used in the transformation of sucrose in nectar into dextrose and levulose in honey. Honey also contains acids, proteins and mineral matters in small quantities as well as colloidal substances that consist in minute particles that do not enter into solution as organic acids, salts and other crystalizable constituents of honey and other substances do.

Honey is a very complex article of food. When food containing starch and sugars is taken into the system there is a definite increase in the amount of sugar in the blood as this is stored up in the body, the sugar in the blood falls to its normal of about one-tenth of 1 per cent. Now while dextrose produces a sharp normal rise, levulose does not. In fact, there is considerable evidence to suggest that levulose is not utilized by the body as dextrose, but is stored in a different and complex manner. What is the effect of the carbohydrates, starches and sugars on our bodies? We obtain our fuel from them. They are converted into invert sugar, dextrose and levulose. Honey is composed of 34.02 per cent dextrose (grape sugar) and 40.50 per cent levulose (fruit sugar). It has been my firm opinion that these invert sugars are finally converted into alcohol and such consumed by the body to produce heat and energy.

Man is therefore an alcohol burning engine, every twitch of a muscle, every movement of the body is produced by the breaking up of a certain amount of alcohol in the system into energy heat and carbonic acid gas.

The carbonic acid gas is finally exhausted by the lungs. If my theory is correct, and I firmly believe it is, man cannot live or have his being without alcohol in his system. And this must be maintained at certain ratio or percentage ratio of body weight.

* Presented at Annual Meeting of Illinois State Beekeepers' Association, Springfield, Illinois, November 15-16, 1932.

This I think is proven by the normal sugar content necessary to maintain health, heat and energy; every movement of the body and vital organs are dependent upon this vital process. The more we exercise the more alcohol is consumed, and the more carbonic acid gas is exhaled. Our lungs are our exhaust pipe by which we get rid of the carbonic acid gas. Even at rest we consume this energy and heat producing substance. Every heart beat, every act of respiration requires some of it; we cannot live without it.

It is therefore important to have the carbohydrate in the most easily convertible form in certain diseases, fatigue, exhaustion, heart-failure, etc. Honey with its invert sugars is this substance. We can now understand why some people are more energetic than others. Their systems, their organs of digestion and assimilation are so constituted as to readily convert the starches consumed into sugar, dextrose, invert sugars and finally alcohol, in which state it is broken up into heat, energy and carbonic gas; which gas is exhaled by the lungs. But it took the inventor of the carburator of the gasoline engine to teach us the proper use of alcohol to be consumed by the body.

Just as too light a mixture of gas in the gasoline engine fails to give proper combustion and energy, or too heavy a mixture stalls the engine, just so the human engine. Too light a mixture of alcohol consumed by the body fails to give the proper amount of energy and a too heavy mixture of alcohol stalls the human engine, and the person is said to be under the influence of liquor, he is drunk and perhaps unconscious. He is not able to navigate, and must first get rid of the surplus alcohol, seek its proper supply or mixtures before he is again normal. Just as too heavy a mixture of gasoline will foul the engine, just so with too much alcohol; too heavy a mixture will foul the human engine; harden his liver, impair or destroy other organs of digestion and assimilation, and affect the heart and circulation. This alcohol question is a dietetic problem, and a great deal of laboratory work is still necessary. But it will never be solved until we fully understand the physiological requirements of the body and then adapt ourselves to our requirements to insure our health and happiness.

Whenever we go contrary to nature we suffer, when we aid or assist nature we benefit thereby. I take from my observation and study that man was never intended to consume a high percentage of alcohol, since the normal percentage of sugar in the blood is about one-tenth of 1 per cent, the alcohol requirements cannot be much higher. We do know that a high percentage of alcohol is destructive to tissues and should not be used. We look upon man with too much liquor as just too bad. As a matter of fact his metabolism has suffered as a consequence and should be considered sick or poisoned from an over dose of liquor.

Solomon understood this action, he made the drunkard say, "They have beaten me and I felt it not, I will seek it yet again," and for its effect upon the mind, he said, "Give wine to him that is of heavy heart and strong drink to him that is ready to perish that he may drink and forget his misery." Healthy people as a rule do not need to consume alcohol, their digestive metabolism meets their requirements. In this

connection let us not forget that our normal temperature is constantly maintained at about 98.6 Fahrenheit by internal combustion. This is brought about by a regulative system we may call thermastats within the nervous system.

Try to regulate the heat of your home at a certain temperature and you will find it difficult and will realize the importance of a first class furnace kept in a first class condition and the best fuel that money can purchase. You will then realize the importance of maintaining your body in a healthy condition and the use of the best of foods. And when I say the best of foods, I mean a proper ration of carbohydrates, proteins, fats, mineral and water. Foods that are not detrimental to the system but meet the requirements of the body and one of these is honey. Honey should take the place of sugar wherever possible, since honey with its invert sugars, does not cause the metabolistic disturbances that sugar often does when consumed in too large a quantity. Honey is not taken in such large quantities and is already partially digested and readily absorbed into the circulation. It should be used in preference to alcohol as a stimulant or heart tonic.

To those people who are in the habit of eating a large quantity of candy and sugar, let me ask you this question, "Have you ever stopped to consider why you do this? Is this a natural or an abnormal craving; are you restless, discontented, running to movies, shows and ball games in place of enjoying your own home?" If so, cut down on your sugar consumption and eat honey and become more normal and contented at home. You are showing signs of internal derangements, your metabolism is not working as it should. You are starving because you have eaten too much, your system cannot consume what you have eaten; you are not able to digest the food that is in a concentrated form. Eat more ruffage, nature's food, in place of man's refined concentrated products and you will get along better.

Let me ask those who are given to strong drink and say they must have it regardless of cost or consequences, "Have you ever stopped to consider why you think this is necessary or what may have gone wrong with your system that causes you to have this abnormal craving?" To me, the indications are that you have a very badly deranged metabolism. Your system is starving for this energy and heat producing material and is not able to obtain it because your digestive organs are deranged by strong drink, and are not able to carry on a normal digestive process to supply this substance naturally. Alcohol, as such is destructive to the delicate tissues and should never be taken internally as such, but in a very diluted form. If these alcohol addicts will stop taking strong drink and use honey instead they may regain their health, provided the destructive process has not gone too far for recovery.

On the other hand, alcohol in dilute form as fermented beer and light wine or the distilled whiskey or brandy in dilute form, will act as a diffusible stimulant, particularly when taken with the meals. If a person requires any stimulant at all, each person must decide for himself which form is best adapted for his system's needs. Moderation, then, is the watch word, and careful attention to our diet will lead to

health and happiness. When Augustus-Julius-Caesar dining with Pallio Rumilius on his hundredth birthday inquired of him how he had preserved both vigor of body and mind, Pallio replied, *"Interius Melle Exterius Olei."* That means in English, internally by honey, externally by oil.

Closely allied to this subject is the use of strained honey in preserving fruit and fruit juices in preference to sugar. First, it is a better food product; and secondly, the use of a proper amount of honey will keep the fruit and fruit juices from freezing when sugar will not.

The usual amount of sugar used in canning fruit, is one cup of sugar to one quart of fruit. If honey is substituted, this would mean a mixture of one and five and will not freeze at 10 degrees Fahrenheit below freezing. As the amount of honey is increased the freezing point is lowered. Preserves contain about equal amount of fruit and sugar; if honey is used the preserves will not freeze about 30 degrees below zero. The freezing point of fruit juices will depend upon the amount of honey used in the mixture. A palatable mixture should produce an outlet for both fruits and honey; where freezing is an item, honey should be used.

The more I study honey, the more I am impressed with it as an important item of food, and attribute my present condition of health very largely to the daily consumption of honey. Pallio Rumilius did not state what kind of oil he applied externally, whether he used olive oil, castor oil, or goose grease, I assume that he had access to all, so I am at a loss as what to use. But perhaps some day some student will delve into the records of the past and discover the particular kind of oil used, and then we will have the formula by which Rumilius enjoyed his long life, and well preserved body and mind.

DEMONSTRATIONS WILL SELL HONEY.*

(MALITTA F. JENSEN, American Honey Institute.)

Anything employed to influence people favorably is advertising. It may be the spoken word, it may be something done, or it may be the written word. We know it takes advertising to sell a product.

All three mediums are employed in demonstrations. We have the spoken word, for all demonstrators talk, don't they? We have action, for the demonstrator works as she talks. Then, when she finishes her demonstration, she usually distributes printed recipes, and so we have the written word.

In other words, beekeepers who include honey demonstrations in their advertising program are using a gun with three barrels instead of one.

You have noticed too, how much more readily you or any one else can do a thing after being shown.

The average homemaker has considerable doubt as to what she can do with honey; she's afraid before she starts. She reads the recipe and thinks it sounds good; perhaps she will go ahead and make up the combination. But she never goes ahead with quite the interest and enthusiasm as the woman who has been to a honey demonstration.

Here are two exhibits, one is the regular straight honey exhibit and it will attract passersby. Here is another honey exhibit with a demonstrator—there is action, she is answering questions, she is preparing food with honey, she is distributing recipes. I need not tell you which one of these two exhibits sells the most honey and I need not trouble to tell you, I am sure, which one of these advertising plans increases more rapidly the consumption of honey. Remember, it is not just honey sold that we want, but honey consumed, for unless honey is consumed, repeat orders are not forthcoming. Without repeat orders, our business cannot be on a solid foundation.

The twentieth century homemaker is a very busy one. She is practical and is interested in doing things according to twentieth century methods. She grasps things so much more quickly from demonstrations than from literature. Her first knowledge is gained from demonstrations and that knowledge is increased by the printed matter distributed. Look about, beekeepers, everybody is demonstrating these days—equipment companies, furniture companies, food companies and automobile companies. How many automobiles would be sold these days if demonstrations were not given. Perhaps you think there is no comparison between automobiles and honey. I know of one salesman who found

* Given at St. Louis Annual Convention, American Honey Institute, February 28 to March 1, 1933.

it much easier to sell automobiles than honey. Check back on the large food companies that have enjoyed sales of their food products these past few years and what will you find? You will find every salesman properly trained to demonstrate the food products he is selling. You will find that salesman receiving printed matter every week and sometimes two and three times a week from the sales promotion office of the company he works for. That printed matter is full of advice on how to demonstrate those particular foods in order to increase sales and consumption.

Yet, we turn everybody and anybody loose to sell honey! We do not give them special training. It matters not whether they know much about honey, for honey somehow seems to sell itself. That day has passed and we must realize the value of showing the homemaker just how to use honey. Beekeepers and honey salesmen must accept the housewife or homemaker as she is—you or I can't make her over. If she doesn't appreciate honey, let's not blame her, but ourselves. Let's fit our product and its use into her scheme or program of homemaking. Then we will be good honey salesman.

Every honey salesman should be a honey demonstrator. Why not? Every Heinz salesman has to be a demonstrator and just think he has 57 varieties to give demonstrations of.

Demonstrating is such a big subject that it is impossible within the limits of a single issue to present more than a small part of what should be said about it. Before outlining briefly the fundamental principles upon which modern demonstrating practice is based, with special reference to the preparation of honey exhibits, the advantages of color combinations, the selection of places for demonstrations, and the importance of the right demonstrator, I want to read you a few letters from Institute mail bag to let you hear what beekeepers and others say demonstrations are doing to sell honey.

Michigan.—"We are demonstrating honey in stores all the time and selling what seems to me like lots of honey (55 tons so far this year.) We work mostly in the industrial east, but I went to McCrory's 10-cent store in Indianapolis for Honey Week and I never before could sell honey in Indianapolis, but we sold 200 cases of comb." M. M. Dillon, Fruit Ridge, Michigan.

Florida.—"We had so many people at our honey demonstrations during Farmers' Week, that we were 'cleaned' out of everything. I wanted to send you a sample of honey citron cake which was delightful both as to texture and flavor. Our homemakers are using more honey than ever before." Isabelle S. Thursby, Extension Economist in Food Conservation, Tallahassee.

Indiana.—"As a home economic extension worker, I am writing for a new supply of your very interesting and helpful recipes and folders on honey. I have a class of sixteen homemakers and have many requests for information and recipes on the use of honey. After demonstrating the use of honey, I find our women much more interested. Many of them are using it in their homes every day in new ways and like it very much." Mrs. Lewis Schafer, Coal City, Indiana.

Wisconsin.—"I wish you could see the crowd I have at my place at times when I demonstrate honey, and believe me, they like the flavor of honey in cakes, cookies, fried cakes, and pies; lots of them are using honey in their baking now." Mr. Jacobson, Kaukauna.

The county agent of his county tells me that folks come from miles and miles to Mr. Jacobson's home not only to see how his honey is extracted, pailed or bottled, but also to sample his honey carmel cake, and get honey recipes. For a number of years he has received blue ribbons on his honey cakes and preserves at fairs.

I am not going to take time to discuss:

What Your Demonstrator Ought to Know Before She Demonstrates.

Personal Qualifications of Your Demonstrator.

How to Lay Out an Exhibit.

Value of Food Combinations on Display.

Preliminary Outline for Demonstrators to Follow.

And Good Dishes to Display and Make Up—You can get all of these from the special sheets known as Demonstrators Outline, copies of which may be obtained from American Honey Institute. I have brought along copies and those of you who wish, may have them.

Are you taking advantage of every possible opportunity to get honey demonstrations given? I mean by that, are you contacting your local domestic science teachers, are you contacting your home service directors of your gas and electric companies, are you getting in touch with newspaper cooking school teachers? If you do not have someone in your own organization that can demonstrate honey, you can cooperate with the women who are demonstrating foods. Many of them will thank you for calling their attention to honey. Offer these people some honey for their first demonstration, give them an outline for honey demonstrations, get recipes for them from American Honey Institute or tell them of the testing kitchen American Honey Institute maintains and that honey recipes are free for the asking. These women will be glad to include honey recipes in their cooking school programs and I know of no better way to get them started than to give them a few pounds of honey.

Honey costs money and we can't afford to give it away, some beekeepers reason. Take a paper and pencil and figure 5 pounds of honey at 10 cents per pound most of you are selling it wholesale for half of that. That 5-pound pail of honey you give the cooking school teacher is valued at 50 cents. How much advertising could you buy for 50 cents? For 50 cents worth of honey that person is going to show several hundred women perhaps, how to make one or more honey dishes. Some of these hundred women are going to make that honey dish and will tell others about it, the number grows and you will never know just how many women used honey as the result of that 50 cents worth of honey you invested in advertising by giving it to a demonstrator. Don't be surprised like this beekeeper was: I quote—

"I offered our domestic science teacher some honey to use in her classes and she took me up on it. Now, if you have any information especially suited for this purpose, please send it to me and I will see to it that she gets it."

American Honey Institute gets demonstrators for large food companies to include honey in their demonstrations. What the Institute is doing nationally in the way of honey demonstrations, beekeepers can do locally. The Institute will help you carry on locally by providing sheets of directions for demonstrations, tested recipes, exhibit outlines, and other special information you may wish.

Every beekeeper should read suggestions for honey demonstrations whether he expects to demonstrate honey or not. He should see that every person who sells honey for him reads these suggestions as well as every word in the Institute material under title of "Using Honey." Then when some housewife says, "I never use honey," your salesman won't just walk away and say "thank you," but will come back with proper words and find out WHY the housewife does not use honey and show her in an interesting way and quickly, too, how she may use honey to her own pleasure and satisfaction.

The twentieth century honey salesman will not just use the spoken word to sell honey, he will demonstrate, speak and give printed recipes, too. A three barrel gun is more effective than a one barrel one, isn't it?

We must do as our other food friends are doing. American Honey Institute will lead the way if beekeepers will follow. We must think of ourselves as did Billy—

Billy and Mary were walking home from school one evening—they were youngsters about eight and seven respectively. Mary said to Billy:

"You know I think you are a lot better looking than your daddy."

"And why shouldn't I be?" asked Billy, "I'm a later model ain't I?"

Why shouldn't the Institute do more to help your honey market than previous organizations—it was organized on later principles. It must help you and you must let it help you. Every beekeeper should be thoroughly familiar with American Honey Institute and how it works. If your neighbor beekeepers ask you about the Institute, be prepared to tell them. Don't do like Rastus did—your guess might be even worse than his was.

Rastus was serving breakfast to Mr. Smith.

The fruit course, honeyed grapefruit of course, was served and all was well.

Then came the the bowl of oatmeal. Mr. Smith started on this and noticed something black in it, he thought it looked like some sort of a fly. He called Rastus over, and said—

"Rastus, what is this in my oatmeal?"

"I dunno sir, unless it be 'un of them thar new Vitamin Bees."

Demonstrations are selling honey and will continue to sell honey. Whether or not they sell your honey, depends on how much you use them.

Institutes' Program.

EDUCATING THE HONEY USER.

1. Getting bakers to use honey.
2. Interesting home economic teachers to include honey lessons.
3. Stimulating hospital dietitians to use honey in diet kitchens.
4. Working with children specialist to recommend honey in child feeding.

5. Showing restaurateurs how honey may be successfully used in restaurants and hotels.

6. Inducing experiment stations to publish honey cookery leaflets.

7. Interesting food and equipment companies in recommending honey with their own foods and supplies in their advertisements; building thousands of dollars worth of good will. Example, Pabst Corporation, Kelloggs, DuPont, Sunkist Fruit Growers, Glass Container Association, National Dairy Council.

8. National honey broadcasts by outstanding companies, as General Mills, Great Atlantic and Pacific Tea Company, and others.

9. Placing honey recipes in national magazines, in cook books, in local papers and in trade journals.

DIRECT HELP TO BEEKEEPERS.

1. Promoting National Honey Week.

2. Stimulating Honey Research; finding new uses for honey.

3. Interesting State Fair exhibitors in honey cooking and honey demonstrations and in using Institute representatives to conduct such exhibits and demonstrations.

4. Showing beekeepers' wives how to develop honey markets.

5. Preparing honey advertisements, suggestions for honey salesmen, outlines for store windows, food shows, etc.

6. Furnishing honey literature at cost to beekeepers to distribute to customers.

REVIEW OF THE 1932 HONEY SITUATION.

(By HAROLD J. CLAY, Associate Marketing Specialist,
U. S. Department of Agriculture.)

The size of the 1932 honey crop was a disappointment to beekeepers over most of the United States. In the spring it appeared that a bumper crop was in prospect in many areas, but due to unfavorable weather—lack of rain in some sections, and too much rain when the honey plants were in bloom in others—the end of the season came with a good crop reported in only a few important states. Among the leaders were Michigan, Ohio, Illinois, Nebraska and California.

Winter and spring losses were heavier than usual, and were not made up from package bees to the usual extent, because of the widespread necessity for retrenchment in expenses. The lower express rates on package bees from the South, though of restricted value because of the lateness of the effective date, increased package bee shipments towards the end of the shipping season.

Brood-rearing was continued late, and colonies generally went into winter quarters with an ample supply of young bees. Winter stores, however, are often lighter than is desirable. Because of the low price of honey natural stores were often left heavier than customary, but in many areas the fall flow was below normal. Further, the early fall was milder than usual over most of the country, permitting flight activities that caused heavy early consumption of stores. Beekeepers are accordingly anticipating a winter loss heavier than average, especially among the non-commercial apiaries.

Not only was the size of the 1932 honey crop disappointing but the monetary returns have also been low. Bartering, or exchanging honey for goods and services, has been practiced much more widely than ever before, however, and many beekeepers have disposed of their honey, and are well supplied for winter with groceries, clothes, etc., though little actual cash has changed hands.

Many other beekeepers, including carlot producers, have packed honey in small containers and sold it direct to the consumers or to grocers. The low retail price of honey,—lower than corn syrup in some western sections—is increasing the distribution of honey, and local sales are disposing of a large proportion of the crop. Carlot sales in 120-pound cases to outside points have not been entirely abandoned, but many beekeepers are finding increased profits by selling locally in the smaller containers.

This season has seen an increase in the trend away from section comb honey. A specialized market still exists for well-graded section comb wrapped in cellophane, but unwrapped comb sells very slowly.

Bulk comb is still popular in the South; and the new cut-comb package is meeting with an active demand.

Export demand, though still lighter than that of several years ago, has recently been more active, and large lots have gone to England, Germany, Italy and France, and smaller amounts to other countries. California Light Amber Alfalfa has been in especial demand for export.

In spite of prevailing low prices, beekeepers are more optimistic than they were a year ago. They realize that most farmers generally are in worse plight than most beekeepers and they are looking forward to the future with a fair degree of confidence. On many farms the sale of honey has this year provided a cash income when other usual channels failed. In some cases, however, the price of honey has been so low that the farmer-beekeepers have not given their colonies any winter attention, and a large proportion of such colonies can be expected to die.

GLIMPSES OF BEEKEEPING IN ILLINOIS.

(V. C. MILUM, University of Illinois.)

This short narrative is an attempt to review a little of the history of the beekeeping industry in the State of Illinois, but since the writer has been connected with the industry for only a comparatively few years, he must of necessity depend upon the more or less written or published records for his information.

Lack of time and space prevents us from reviewing all of the literature and including all of the facts pertinent to this subject. It may therefore happen that certain important events may be overlooked, for which due apologies are here offered.

EARLY ILLINOIS BEEKEEPERS.

As we scanned through the records in the Annual Reports of the Illinois State Beekeepers' Associations and the American Bee Journal, we found some interesting information in the July, 1872 issue of the latter. "Old Grandfather," writing from Marine, Madison County, Illinois, on May 20, 1872, stated that he had kept bees in Illinois since 1835. In discussing his early successes, he pointed out that in spite of his crude methods and lack of knowledge, one of the factors in his success was that there were few bees to gather the enormous nectar supply of the boundless expanses of flower covered prairies. "Old Grandfather" stated than 15 years later or by 1850 conditions were much changed with fields of corn and wheat replacing the flowers with the result that swarms were reduced in strength and moths became a serious pest. This writer recommended reading of bee books and bee journals and securing advice from experienced beekeepers for those who contemplated keeping bees. The writer stated that during 1872 the agents for patent hives had been especially active that year.

"Old Grandfather," whoever he may have been, must have been one of the pioneer beekeepers, but the Annual Report for 1891 lists D. J. M. Phillips of Belleville as having kept bees for 50 years, D. W. Bellemey of Vienna for 45 years and S. W. Block of Clayton and Samuel C. Ware of Towando for 40 years which makes them beekeepers as early as 1851, although a part of the time may have been in other states.

The January, 1873, issue of the *American Bee Journal* indicates that at St. Charles, Illinois, there lived the well known beekeeper, M. M. Baldridge, who is characterized by Mr. C. P. Dadant in the 1921 Illinois Annual Report as "one of the earliest pioneers in beekeeping and a member of the first National Convention ever organized." Mr. Dadant also states that Illinois "was the home of Mrs. Lucinda Harrison,

living at Peoria in 1891, who, for years wrote of beekeeping in the *Prairie Farmer*".

The history of beekeeping in Illinois, can in part be told by reciting the deeds of some of its leading and nationally known, even internationally, beekeepers. Probably of first consideration among these is Mr. Charles Dadant, who was born in Burgundy, France, May 22, 1817 and died at Hamilton, Illinois, on July 16, 1902. Charles Dadant was formerly a merchant at Langres, France, but moved to America and to Hamilton, Illinois, in 1863 at which time his son C. P. Dadant who celebrated his 82nd birthday on April 6, 1933, was then only 12 years old.

Soon after their arrival in 1863 the Dadants engaged in beekeeping activities which soon included the manufacture of comb foundations and which gradually grew in importance, forming the nucleus of the present organization of Dadant & Sons, of Hamilton, Illinois. The Sons of this company are those of C. P., namely, Louis, Henry, and Maurice, who themselves are now rejoicing with their grandchildren, thus making the fifth generation of this family of beekeepers.

Charles Dadant was a prominent writer and contributor to American and foreign bee journals from 1870 until his death and so accomplished much in directing the course of beekeeping events, in America, and especially in Switzerland, France, Italy, and Russia, where the hive which he recommended is now known under his name. This hive, with some modifications is still championed by the Dadant establishment under the name of Dadant Hive or "Big" hive.

Charles Dadant was joint author in 1889 of the first, rewritten, revised edition of the Rev. L. L. Langstroth's book, "The Hive and the Honey Bee," first published in 1852. Later editions of Langstroth's book were revised and rewritten by C. P. Dadant who has also been a generous writer for the beekeeping journals. Under the leadership and editorship of the latter, in May, 1912, the *American Bee Journal*, then in its 52nd year was moved from Chicago to Hamilton, where in 1933 it still flourished as one of the leading journals of the industry.

In addition to the writings in the bee journals, there are numbers of publications in book form by C. P. Dadant, his son Maurice, and also from the pen of Frank C. Pellett, Field Editor of the *Journal*. The story of the influence of the Dadants on Illinois beekeeping and that of the country should not be completed without calling attention to their work in the development of the comb foundation for comb, including the vertical, reinforced, crimped wire foundation manufactured in recent years.

Another prominent pioneer Illinois beekeeper was Dr. Charles C. Miller, born at Ligonier, Pennsylvania, July 10, 1831, later living at Morengo, Ill, where he died on September 4, 1920 at the age of 89 years. Attention to Dr. Miller is called by the death of Mrs. Miller, on March 20, 1933, and her sister Miss Wilson on April 1, 1933. The latter worked with Dr. Miller at beekeeping for many years and was well known to beekeepers through the columns of the bee journals.

Dr. Miller was probably the most highly loved and revered of American beekeepers, not only at home but throughout the world, be-

cause of his jovial and sincere nature combined with an excellent investigative and experimental mind. I have before me a copy of the *American Bee Journal* for January, 1909, which bears on the front cover page an excellent portrait of Dr. Miller with a legend which reads, "The Nestor of American Bee-Keepers." It is reported that the presence of Dr. Miller at any convention always meant that harmony would prevail.

Dr. Miller was a contributor of articles to the bee journals for a period of 50 years, first starting in 1870, and during this time served as associate editor of the *American Bee Journal* for a number of years. His column of Questions and Answers in this journal was conducted for over 20 years including the last year of his life. These questions and answers have been in part compiled and published in 1917 by M. G. Dadant in a book entitled "A Thousand Questions and Answers." Dr. Miller was the author of three other books: "A year Among the Bees," published in 1885; "Forty Years Among the Bees," 1902; and "Fifty Years Among the Bees," 1911. Dr. Miller was a special student and master of comb honey production, and also made valuable suggestions for manipulation in the treatment of European foulbrood. At his death Dr. Miller was so well loved and revered by his fellow beekeepers that soon efforts were under way for the establishment of a fitting memorial to commemorate his memory. As a result there was eventually established the Dr. C. C. Miller Memorial Apicultural Library at the University of Wisconsin. This library, since its establishment, has been developed to the point now that it is the most extensive and complete library of its kind in the world.

There are, no doubt, many other Illinois beekeepers of outstanding leadership within the State, but even if we knew them all, it would require volumes to list their records. However, we want to at least mention a few names of those who have been more or less prominent. The name of the Hon. J. M. Hambaugh must be included, for it was through his efforts that the first legislative appropriation for the aid of the industry was secured in 1891, he then being a member of the Legislature. There was Aaron Coppin of Wenona, Illinois, champion comb honey (split-sections) producer, and a charter member of the State Beekeepers' Association, who died on November 17, 1929. Then there was Samuel Cushman, of Chicago, who died on March 3, 1933, a frequent contributor to the bee journals, active in beekeepers' associations, and one of, if not the first college beekeeping instructor in the United States, having many years ago conducted beekeeping and poultry courses at Rhode Island State College.

Among the still living and active beekeepers of the older generation in 1933, we must not neglect to mention, George W. York, present editor of *Bees and Honey,* formerly of Seattle, but now of Alhambra, California, who was editor of the *American Bee Journal* for 20 years prior to 1912 when it was purchased by the Dadants. Then there is James A. Stone, of Farmingdale, charter member of the Illinois State Beekeepers' Association and its efficient Secretary from its origin in 1891, for a period of nearly 29 years, to December 10, 1919. Likewise Dr. A. C. Baxter of Springfield who has been active in the State Organization since 1913 and as its president from 1918 to 1923 and 1926 to 1930. And then

we must mention the name of A. L. Kildow, Chief Inspector of Apiaries, from the establishment of the Division of Apiary Inspection since its founding in 1911. All of these have lent their influence to the development of beekeeping, but they have been assisted by many others, too numerous to mention.

The American Bee Journal in Illinois.

The American Bee Journal, with which all Illinois Beekeepers are so well acquainted was founded on January 1, 1861, by Samuel Wagner, at Philadelphia. It was discontinued for a few years during the war and was later published at Washington, D. C., until January, 1873, when it was taken over by Rev. W. F. Clarke, with office at Chicago. The death of Samuel Wagner occurred on February 17, 1872, the journal being published during the remainder of the year by his son, Samuel Wagner, who continued to cooperate with the new editor by translating German articles.

With the August issue, 1874, the management of the *American Bee Journal* was assumed by Thomas G. Newman and consolidated with the *National Bee Journal* under the former name with offices at Chicago and Cedar Rapids, Iowa, with W. F. Clarke and Mrs. E. S. Tupper, listed as editors until June, 1875.

On June 1, 1892, the *American Bee Journal* was taken over by George W. York, who had been connected with publications of the journal for a period of eight years previously. Mr. Newman continued for a time as joint editor with Mr. York who remained the owner and editor of the *American Bee Journal* until 1912 when the editorship and management was taken over by Dadant & Sons of Hamilton, Illinois, who have successfully carried on to this day. Mr. York moved to Washington, where in 1920 he established *York's Bees and Honey,* published at Spokane until 1925 and then at Seattle until 1930, when the office was moved to Alhambra, California, at which point the journal was still being published by Mr. York in 1933.

There is no doubt but what this journal and its editors have exerted a vast influence on Illinois beekeepers and their methods and practices.

Illinois State Beekeepers' Association.

Illinois beekeepers have long been organized, the Illinois State Beekeepers' Organization being founded at Springfield, Illinois, on February 26, 1891 for the purpose, among other things, of securing appropriations for a State apiarian exhibit at the World's Columbian Exposition. The State association, however, was preceded by the Capitol Beekeepers' Association, which had been in existence for some five or six years and then apparently disbanded.

The Illinois State Beekeepers' Association, from its origin, has been quite favorably treated by the State Legislature. Shortly after its birth on June 16, 1891, the sum of $500.00 per annum was appropriated for "the publication of reports and information pertaining to the industry as will tend to promote the growth and develop the apiarian interests for the year 1891 and 1892." This appropriation was apparently due

to the efforts of the Hon. J. M. Hambaugh, then a member of the House of Representatives who was elected president of the association in 1893.

In 1892, the first Annual Report was printed, it being the first of a series of thirty bound volumes up to and including, as this is being written, the combined report for the years 1930 and 1931 bound in one volume. The Legislature having failed to appropriate any fund for the printing of reports after 1893, the second Annual Report was not printed until early 1894 and included the years 1892 and 1893. However, for a period of approximately 10 years, no appropriations were made for we find the third annual report for the year 1903 issued in 1904 and the fourth for the year 1904 issued in 1905 with James M. Stone, the association's first elected secretary still serving in that capacity and continuing to do so until December 10, 1919. After that the printed Annual Reports came out regularly each year until 1930 and 1931 when the years of 1930 and 1931 were included in one bound volume.

The initial State grant to the State association for 1891 and 1892 was for $500.00 per year, but starting with the appropriation for 1903, the amount was increased to $1,000.00 per annum "for the purpose of paying the expenses of holding annual meetings, publishing the proceedings of said meetings, suppressing foulbrood among the bees in Illinois, etc." As more fully discussed under the subject of apiary inspection, a part of the State funds was used for salaries and expenses of apiary inspection up until the passage of the special Apiary Inspection Law in 1911, after which for a few years a part of this fund was used for expenses of deputy apiary inspectors.

Beginning with 1921 the State association fund was increased to $1,200.00 per year of which $200.00 was available for "Shorthand reporter and compiling work," including clerical work and $1,000.00 for "Publishing and distributing reports, expenses at State Fair and annual meeting." These funds are distributed on order of the Secretary of the State association, countersigned by the President and approved by the Director of the State Department of Finance.

County Associations.

Soon after the organization of the State association, that body encouraged the affiliation of members of local, county, and territorial beekeepers' organizations, provision for affiliating members at 25 cents per member being inserted into the Constitution in 1904, and increased to 50 cents in 1910. In 1906, the membership of the Chicago-Northwestern Beekeepers' Association and the Western Illinois Association were affiliated. In 1907, the Illinois members of the Northern Illinois and Southern Wisconsin Association were affiliated. The Chicago-Northwestern Association apparently had existed since 1879 or 1898 (18th Annual Convention, 1915) although there are some conflicting statements in the reports of its annual convention as printed in the State Association Report from 1905 to 1921, the latter year being the last time that its affiliated members were listed separately.

Printed information in the reports regarding local associations other than those just mentioned is rather meager, but in the 1932 report

there are listed a total of 15 associations active within the State and probably all affiliated with the State association. At about this time special effort was placed on the organization of local associations. For 1923 there were listed 26 associations, with 29 for 1924. The totals for 1925 were not reported, but for the first time there were included the Annual Reports of the local associations, which feature has been continued up to this time. The number of associations has varied some in recent years with disbanding and organizing until in 1930-1931, there were approximately 30 local associations with a total State association membership in 1931 of 688 beekeepers of which only 86 were members-at-large.

Apiary Inspection.

Other than the bill for the appropriation for publishing reports, passed in 1891, the first ever passed for the benefit of the industry, two other bills were introduced in the same session of the State Legislature. The first of these was to prohibit the spraying of plants or trees while in bloom with any poisonous material. The second was "an act for the suppression of foulbrood among bees and making appropriations for the expenses of the work." Among other things, this act provided that the State association should select the State inspector and his deputies. The act also provided for the listing of colonies by the association and the laying of a special tax of 5 cents per colony to be used to suppress foulbrood among bees. However, these last two bills failed of passage, the one in regard to spraying not being mentioned in the reports after 1906. It seems that this bill met too much opposition from the fruit growers.

Apparently nothing was done regarding apiary inspection until after the State association again secured an appropriation of $1,000.00 per year in 1903 and 1904, the bill authorizing this sum stating that one of the expenditures to be allowed was for "suppressing foulbrood among bees." While there were apparently no definite rulings regarding apiary inspection, the records show that the State association held a meeting at Springfield, on June 18, 1903, at which time Mr. J. Q. Smith of Lincoln was elected to the office of foulbrood inspector of Illinois for the two years of 1903 and 1904 with a recommended salary of $4.00 per day and expenses for time actually and necessarily spent in carrying out the intent of the law. The secretary's report for 1903 shows the sum of $106.10 having been expended for apiary inspection.

The State Legislature was asked to appropriate a sum of $1,200.00 per year for 1905 and 1906, the original bill providing for the appointment of an apiary inspector and listing certain regulations for control of foulbrood. This bill was passed but with the amount reduced to $1,000.00 per year and with the provisions for foulbrood regulations and inspector detached, as a separate bill which failed to pass the House.

Apiary inspection continued to be carried on under the funds granted to the State association. In 1908, we find listed the sum of $461.89 having been paid to J. Q. Smith and his assistants. The work was continued under Mr. Smith's direction in 1909, the year of his death. At the following convention on November 18, 1909, Mr. A. L.

Kildow, who had been the most active inspector that year, was elected foulbrood inspector, which office he has continued to hold throughout the intervening period to and including 1933.

During the year 1910 petitions were circulated among the beekeepers asking the Forty-seventh General Assembly to enact a law providing for the appointment of a State inspector of apiaries and he in turn his deputies, the total expenditures not to exceed $600.00 per year. The annual reports seem to indicate that the sum of $3,000.00 was asked for the years 1911 and 1912 with a companion bill providing for not more than three-fourths of this amount to be expended for foulbrood inspection.

On June 7, 1911, House Bill No. 670, the first definite foulbrood law was signed by the Governor, to take effect July 1, 1911. This provided that the Governor appoint a State inspector of apiaries, together with provision for inspection and penalties for non-observance of the law. No amount of money to be appropriated was mentioned in this bill but a part of the funds apparently were to come from the direct appropriation to the State Beekeepers' Association, since the companion bill still contained the clause, "suppressing foulbrood among bees in Illinois, etc." However, the report of the discussions following, Mr. Kildow's 1912 report indicates that a sum of $1,500.00 per year was available for the State inspector per diem and expenses and deputies per diem. The Secretary's Report for 1911 showed expenditures for inspection and again in 1912 the report showed items expended for inspectors which were for expenses (not salaries) of deputies.

Beginning with July 1, 1911, inspection work took on renewed activity with $1,435.17 being expended for inspection in 1912. A few figures available for other years are as follows: 1916—$1,094.24; 1917—$1,823.34; 1919—$1,737.16; 1920—$1,616.48. Somewhere within this period the practice of using a portion of the State association funds was discontinued.

After 1917 the apiary inspection work was placed under the supervision of the Director of the Department of Agriculture. In 1921-1922 the appropriation was increased to $3,000.00 per year. The 1922 association meeting recommended the sum of $12,000.00 per year for apiary inspection, but the Legislature passed an annual appropriation of $7,475.00 per year for the biennium beginning July 1, 1923. The amounts have been gradually increased until the biennial appropriation amounted to $35,850.00 for the 2-year period of July 1, 1929 to July 1, 1931, the amount having been greater at one of the previous periods. As this review is being written in 1933, the Legislature is in session with reports that the appropriation amounts will be considerably reduced in the interests of economy.

Bee and Honey Exhibits at Fairs.

At the organization meeting of the State Beekeepers' Association in 1891, one of the purposes given was the necessity and desirability of securing an appropriation to finance an exhibit of Illinois honey at the World's Columbian Exposition held in Chicago in 1893. In the discus-

sions, Thomas G. Newman, then editor of the *American Bee Journal* stated that Illinois ranked second of the states in honey production with some 20,000 beekeepers within the State. Another statement that same year, placed the number at 10,000. The State Legislature finally made a grant of $3,500.00 in May, 1933, for the apiary exhibit. Although the exhibit was to be in place by May 1st, Illinois immediately put up a creditable exhibit to win the first place bronze medal which is now in the State Historical Library at Springfield.

Although honey had been exhibited at the Sangamon County Fair at Springfield in 1891 and previous to that date, the writer is not exactly sure when bees and honey were first included on the premium list of the State Fair, but statements by Mr. Becker given in the report of the Annual Meeting for 1905 indicated that probably honey and bees had been included, from the organization of the State Fair. Some of the discussions indicated the existence of a State Fair premium list, for at least 5 or 6 years previous. Even at that meeting there was debate on the premium on beeswax and on limitations of amounts of honey, which may be of interest to some who have attended some of the conventions of recent years.

However, at the Annual Meeting of December 16-17, 1891, a committee of five was appointed to prepare and report a premium list for apiary exhibits at fairs, to be presented to the managers of the State Fair and all fairs within the State, to serve as a model for all such premium lists. The report when presented contained 17 items with 1st and 2nd premiums amounting to $159.00, the report being referred back to the committee made standing for further consideration.

Due to the fact that there are no printed records of the State associations for the period from 1894 to 1902, there is necessarily a gap in the available printed knowledge. In the report for 1903, the secretary reported upon the activities of the Premium List Committee, claim being made that the Illinois premium list lead those of all other states. This report conveys a slight impression that this was the first State Fair exhibit, but we have previously indicated otherwise. A suggestion was made at that early date that entries be limited to the State only. Among the exhibitors at that time were Jas. A. Stone & Son, Geo. Poindexter, Chas. Becker and Aaron Coppin and wife, the first of whom is still exhibiting and the latter until his death in 1929.

The report for 1908 contains the first reference to and copy of the "Code of Rules and Standards for Grading Apiarian Exhibits at Fairs," as adopted by the Illinois State Beekeepers' Association. This code, excepting for the elimination in 1910 or 1911 of a preference for certain size of sections, is identical with the one still existing and printed in the 1930-1931 report.

For a number of years a premium was given for handling live bees in a cage, but this was removed from the list beginning with the 1915 Fair.

At the 1915 meeting of the State association a resolution was passed asking for a separate bee building with a room for extracting. Due to lack of finances available, this idea was abandoned at that time. While the Governor Emmerson Building was being built, agitation of

the State association secured the promise of a place in that building for a Bee and Honey Exhibit, but when time came for the allotment of space at the 1930 Fair, the year the building was first used, the quarters suggested were far too small and inadequate. As a result, the exhibit was moved to the grandstand exhibit space. As this location has not proved satisfactory, agitation has again been made for a special building for bees and honey. Although this idea has met with temporary suppression because of present financial conditions, certainly the industry is important enough to receive careful consideration on this subject.

For the 1916 Fair additional funds for premiums were voted from the treasury of the State association. It appears that with this Fair the State association had its first separate exhibit from that of the individual beekeepers, the Annual Report for 1916 carrying a picture of the same. This association exhibit included a display of extracting honey at the 1917 Fair and some of the following Fairs but was discontinued a few years ago. The responsibility for the remainder of this special display seems to have been assumed by the Division of Apiary Inspection of the State Department of Agriculture although the schedule for the appropriation for the State Beekeepers' Association as late as 1931-1932 carried this item as a possible expenditure.

It has previously been indicated that one of the early premium lists carried items amounting to a total of $159.00. The Annual Reports contain no further information on this point until 1927 when the amount had been increased to $574.00 for premiums. In 1930, the amount offered was $625.00 which was again increased with the 1932 Fair to $825.00 which included $100.00 in premiums for a separate amateur division. Reports indicate that this last feature has met with the general approval of the Fair officials and the beekeepers.

In addition to the regular Bee and Honey exhibits at the State Fair, a new feature was introduced at the 1930 Fair through the efforts of the State association at the suggestion of Mr. Stanley Smith, and through the cooperation of Miss Ethel VanGilder, superintendent of the culinary division. Premiums were offered on honey cookery with $70.00 being awarded for bread, cakes, cookies, and candies in which honey was featured as the sweetening agent. This idea met with general approval, the premiums being increased to $101.00 in 1931 and $107.00 in 1932. The lot for 1932 included $25.00 for five items of three prizes each on Honey Breads, $30.00 for three items of Honey Cake, $24.00 for three items of Honey Candies, and $28.00 for five items of Honey Cookies. Considerable publicity was given to honey through these premiums, honey pamphlets and recipes distributed and especially by the method employed by Miss VanGilder, of discussing the prize recipes at the close of the judging of the exhibits.

As far as the exhibits of Bees and Honey at County Fairs are concerned, the records are very poor. However, a few instances have been brought to our attention in recent years, among them being the County Fairs of Mercer, Henry and DeKalb counties. This feature of publicity should still be stimulated by the beekeepers and local associations.

As this is being written, the 1933 Century of Progress at Chicago is just about to open. While there is no general exhibit of Illinois Honey, it is said that there is to be an exhibit of Bees and Honey in the General Science Building. We are also told that a large honey bottler will also have a general display of Bees and Honey in one of the Commercial Buildings.

Apiculture at University of Illinois.

At the organization meeting of the State Beekeepers' Association in 1891, resolutions were passed asking the Agricultural Experiment Station of the State University to allot a small portion of its $15,000.00 Federal appropriation to be used for investigation of beekeeping problems. A beekeeper was recommended for the position but apparently the request was not granted.

At the 1912 State convention, W. B. Moore, of Altona, stated that as in 1911 he wanted to urge that attempts be made to establish a course in beekeeping at the State University, his remarks being approved by E. J. Baxter, of Navou. The next day a resolution was passed asking the University to establish an Apiarian Department in the Agricultural College, for the purpose of teaching practical beekeeping, to study bee diseases and make experiments in their prevention and care, etc. President Baxter reported at the 1913 State meeting that he visited the University and discussed the matter with President James and the entomologist, the latter stating that he had asked for an appropriation to instate a course in beekeeping in the University. According to Baxter, the University authorities declined to have anything to do with apiary inspection, not wanting to do any "police work."

As near as we can determine from the University records, a course in beekeeping was first offered in the fall of 1917. This course was apparently of the lecture type covering anatomy and behavior of bees and continued as such a course until 1922 when practical beekeeping was included. Apparently the earlier course was not deemed sufficient instruction in apiculture, for we find that at the 1917 meeting, of the State association, the following resolution was passed: "That we urge the State University to extend the teaching of beekeeping and to make this a special department of agricultural education."

At the 1919 meeting, following a. discussion by F. B. Paddock of Iowa, in which he advocated apicultural education in state universities, Mr. Gill suggested cooperation in making demands. Mr. Bender remarked that the University lacked funds and hence could not get a demonstrator for the apiary work. Mr. Kildow suggested that the demand must come from outside, but no further action was taken.

In the presidential address of the 1920 State Convention, Dr. A. C. Baxter, in commenting upon the death on September 4th of that year of the nationally prominent beekeeper, Dr. Charles C. Miller, of Marengo, Illinois, stated as follows: "No greater memorial could be erected, no greater service to the beekeeping industry could be possible than the establishment of a course of beekeeping at our State University in the name of Dr. Miller, endowed by the many beekeepers who have

gained so much by his labors." A resolution later was adopted reading in part as follows: "Resolved, That we urge the beekeepers of the country to join us in organizing and subscribing a fund for some appropriate memorial preferably an endowment for the education and instruction of young beekeepers at the College of Agriculture."

On the second day of the 1920 convention another resolution was adopted urging the University of Illinois to establish a thorough department in beekeeping, including "a four-year course in instruction, a division for research on beekeeping subjects, and proper educational work throughout the State." The president later urged all beekeepers to contact senators and representatives on the necessity of this last point. Mr. C. P. Dadant in speaking of the needs of the industry said, "We need to spread a greater amount of information on beekeeping by more regular addresses at Farmers' Institutes, by practical and extended courses in beekeeping to our young scientific farmers, at the universities so they may go home with a sufficient knowledge of the honey bee to care for her."

In his presidential address of 1921, Dr. Baxter stated that they had been trying "to have a Department of Apiary instruction at our State University, but due to lack of money and to lack of interest we are still without adequate educational advantage in apiary instruction for our agricultural students."

The annual report of the Secretary of the State Association, Mr. M. G. Dadant, made December 6, 1922, contains the following statement: "A conference was held at the University of Illinois in the effort to get a department of beekeeping there and also to get University authorities interested in the Miller Memorial Library. Unfortunately, insufficient funds prevented the establishment of a complete department at the University, though it is hoped to effect it within another year. The Memorial Library went to Wisconsin." Mr. Gill, speaking before the convention urged establishment of beekeeping courses, research and "an extension program by which a knowledge of correct methods can be taken to the beekeepers who cannot come to a University to study."

During the school year 1922-23, Mr. George E. King served as instructor in beekeeping, being succeeded by O. Wallace Park, formerly of Iowa Agricultural College who was appointed Associate in Beekeeping in 1923 and Assistant Professor in 1924. Professor Park resigned in 1925 to return to Iowa State Agricultural College for a full time research position in beekeeping.

At the 1924 Annual State Association meeting, a motion was passed to the effect "that a committee of three be appointed to get an extension man for beekeeping in Illinois at the University of Illinois." What this committee actually did is not known by the writer, but Vern G. Milum, then an Instructor in Beekeeping at the University of Wisconsin was asked to take charge of the Beekeeping work and as late as June, 1933, was still acting in that capacity.

When the writer came to Illinois he found that Dr. Park had established two courses in beekeeping and had been successful in securing much needed apiary equipment and supplies for conducting these courses and conducting research in quarters known at the University as the

Vivarium Building. The beekeeping instructor then and is still required to assist in the teaching of the general course in Entomology, which is offered and required of all agricultural students. During some semesters this has approximated about half time which factor has necessarily limited the activities along beekeeping lines and should be remembered in considering the accomplishments of the Beekeeping Division.

In recent years two general courses have been offered to those students interested in beekeeping. The first, a two-credit course of four hours per week, not open to freshmen, is known as "Essentials of Beekeeping." It aims to cover the fundamental facts of bee behavior as a basis for beekeeping practices and yearly management which are demonstrated in the University apiary which contains about sixty colonies in various types of equipment which are handled and used by the student. The "Advanced Beekeeping" course of two credits is available to students who have passed the previous course or who are prepared because of previous experience. This course covers the subject matter of the beginning course in more detail with special emphasis on the study of bee diseases and their control and queenrearing. As much actual apiary work as possible is included. Students interested in further work in beekeeping can obtain some under a "Special Problem" course available to seniors.

Students who register for the beekeeping courses are largely agricultural students though there have been engineers, pre-medics, commerce and general students who have had some previous personal interest in beekeeping. Courses in beekeeping have been available to agricultural students only as free electives since they are offered by the Department of Entomology in the Liberal Arts and Science College, although in 1932 beekeeping courses were admitted as electives in certain group requirements. This lack of agricultural credit has probably helped to keep the enrollment in beekeeping courses reduced. The number enrolling are quite small, being in 1932-33 a total of ten for the two courses, one each semester, while from 1925-1928 the enrollment was slightly more than double this number.

If the beekeeping courses are continued, the enrollment may increase since the courses are now somewhat more available to agricultural students. At least students of horticulture and those preparing to teach agriculture in high schools and act as farm advisers should prepare themselves by taking a course in beekeeping. Several of the high school agricultural instructors in the State have groups of boys interested in beekeeping projects. Furthermore, with the increase of sweet clover acreage in Illinois and especially as a soil improver and for pasture the importance of beekeeping to the average farmer has increased.

Since 1923 the Beekeeping Division at the University has offered a Beekeeping Short Course each year in January, in connection with the Farm and Home Week of the College of Agriculture. This course, usually of three days' duration, covers the essentials of bee behavior and management, with demonstrations. Usually additional speakers outside the University are secured to help in the instruction work, which has been considered satisfactory by those who have attended, usually averaging about twenty for each half day session.

In beekeeping research the University has studied the problems of wintering, bee diseases and control, swarm control, queen rearing, requeening, and bee behavior. However, due to other duties of the one person available, the amount of research has been limited.

As for extension in beekeeping, the University Apiculturist has not been as active as some county groups desired. From 1925 to 1930, the writer was able to attend an average of about ten county meetings a year through a small fund slightly over $100.00 available through the College of Agriculture from a Federal appropriation for extension. Since this was not a definite project, the funds were withheld after that time and when efforts were made in 1931 to be reinstated on a definite project basis such as demonstration apiaries it was not possible because of a general curtailment of expenses for extension work. Since that time, the University Apiculturist has been able to attend only such county meetings at his own expense or occasionally where the local associations were willing to defray the expenses. It is not likely that extension work in beekeeping can be reestablished until there is an organized effort on the part of the beekeepers of the State of Illinois.

However, the University Apiculturist has always been willing to cooperate with the beekeepers in the association work, the writer serving as Secretary of the State Beekeepers' Association for the five year period from 1927 to 1932. This position included the editing or compiling of the Annual Reports and editing and writing most of the materials for the monthly and bi-monthly bulletins.

The Beekeeping Division of the University has prepared several mimeographed articles covering various phases of beekeeping which are available upon request. Among the titles are "Memorandum for Illinois Beekeepers"; "Making a Start with Bees"; "Wintering of Bees"; "Successful Spring Management of Bees" and a special circular "Illinois Honey—A Useful Sweet". In addition, there are many inquiries to be answered on beekeeping questions which require considerable correspondence. While there are a number of Federal bulletins on beekeeping available, none have yet been issued by the University, although copy is being prepared for publication.

Other departments at the University are also interested in bees and honey. Professor Tracy of the Division of Dairy Manufacturing has made a special study of honey in combination with dairy products, his results and recommendations being available through the following University bulletins: No. 387—How to Make Honey-Cream; No. 345—Use of Honey in Ice-Cream Manufacture; and No. 377—Making Frozen Delicacies at Home. The Division of Beekeeping cooperated in certain phases of some of this work as well as furnishing the honey samples.

The Horticultural Department has recommended the use of bees for orchard pollination, while Mr. Flint and Mr. Farrar have made certain studies in the use of repellents in sprays.

The University Home Economics Department has been awakening to the possibilities and advantages in the use of honey. In this connection, the Beekeeping Division was asked to prepare a display of the production and use of honey for a joint display covering the utilization of farm products, made at the 1933 Farm and Home Week. Because

of the interest shown and the demands for information, from Illinois housewives, a radio talk was given over the University Station W-I-L-L, on May 15th, on "Honey—An Economy Food." The Home Economics Department has also included instructions for rendering beeswax and its utilization in making floor polish in a circular entitled, "Some Helps to Reduce the Cleaning Costs."

With such attention as listed being given to the industry by the State University, Illinois beekeepers should see that they are constantly represented at that institution by someone who will cooperate with them in their problems and plans and promote the utilization of their product.

BEES AND THEIR CARE.*

(J. A. MUNRO, Entomologist.)

WORKER QUEEN DRONE

Success with bees is most likely to be achieved by the person who has a natural liking for them, who has a fair knowledge of their habits and who has the time and inclination to give them the care they require. Other factors of prime importance are a suitable location for the colonies and the necessary equipment for conducting the enterprise efficiently.

Before engaging in the business of keeping bees the prospective beekeeper should read and study the available literature on the subject. It will also pay him to discuss his beekeeping problems with some experienced beekeeper in his own community. It is wise to start in a small way; one or two hives are enough for the first season. If after the first season's trial he concludes that he likes the business he will be in a position to enter the second year on a more extensive scale. The experience gained the first season will not be costly, as the initial outlay for one or two hives is comparatively small.

Getting the Bees: A start may be made by purchasing hives of bees locally or by the purchase of package bees and new equipment from dealers. Names of dealers in package bees and bee supplies may be found listed in the advertising columns of any of the bee journals.

Hives of bees may be obtained locally but should be purchased in compliance with the State bee law which requires them to be accompanied by an official certificate of inspection showing them to be free of American foulbrood. To further safeguard the industry the State law

* Circular 112—Agricultural Extension Division, North Dakota Agricultural College, Fargo, North Dakota, March, 1932.

prohibits the bringing in of bees on combs and used beekeeping equipment from points outside the State.

Choosing a Location: In choosing a location or apiary site three important points should be borne in mind. First, the apiary should be located close to an adequate supply of bee pasturage, including sweet clover and other nectar producing plants. Second, the apiary should be protected from the cold north wind, especially during spring and fall, by a natural shelterbelt of trees. Third, the apiary should be readily accessible to a good highway but situated so that the bees will not be a nuisance to passers-by.

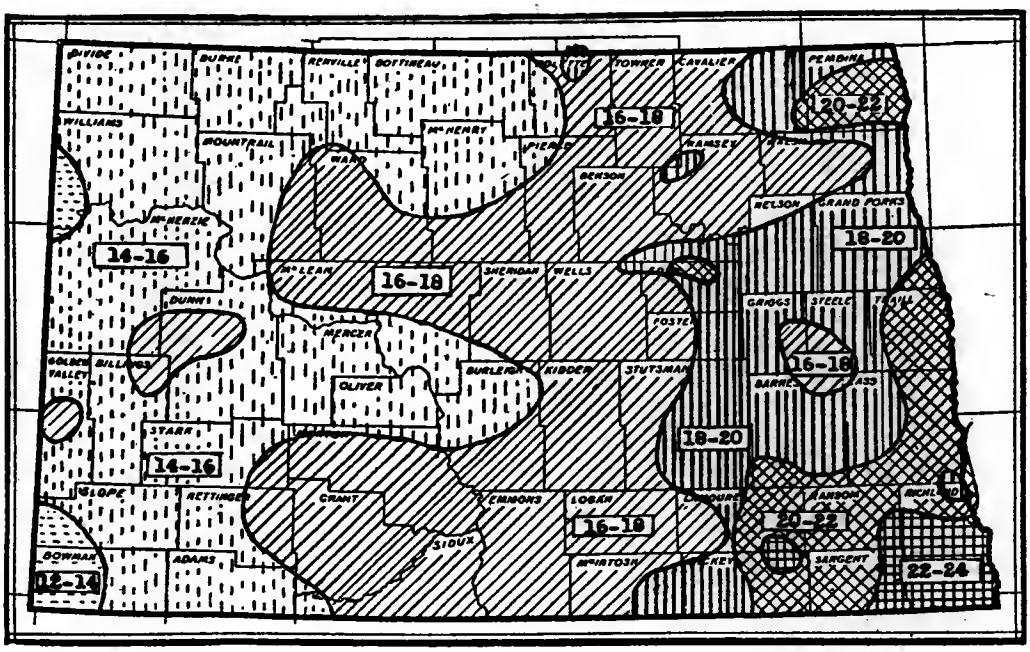


Figure 1—Average annual precipitation. Data from U. S. Weather Bureau.

Weather, especially rainfall or precipitation, has an important bearing on beekeeping. Plants require rainfall, or moisture supplied in other ways, otherwise they fail to produce nectar. In areas of the state having inadequate rainfall and frequent periods of drought beekeeping may be considered an unprofitable venture despite an abundance of nectar producing plants. Where the rainfall is fairly adequate and the nectar plants are in sufficient quantity, beekeeping will yield the most satisfactory returns.

During most years beekeeping can be carried on satisfactorily in practically every county in North Dakota. In areas subject to intermittent periods of drought and limited in amount of bee pasture, it is not advisable to engage in beekeeping as a commercial enterprise.

Beekeepers who plan to engage in beekeeping in a commercial way should study the rainfall areas of the state and the relative amount of pasture available for nectar.

Sweet Clover Most Important: Sweet clover bloom is the most important source of honey in North Dakota and yields most abundantly during July and August. During early spring and until sweet clover

is in bloom it is desirable that the bees have access to early sources, including willows, maples, elms, dandelion, fruit bloom and other nectar producers. These sources are of particular importance in that they stimulate brood rearing in the hives and cause the colonies to be of proper strength when the main nectar flow from sweet clover begins.

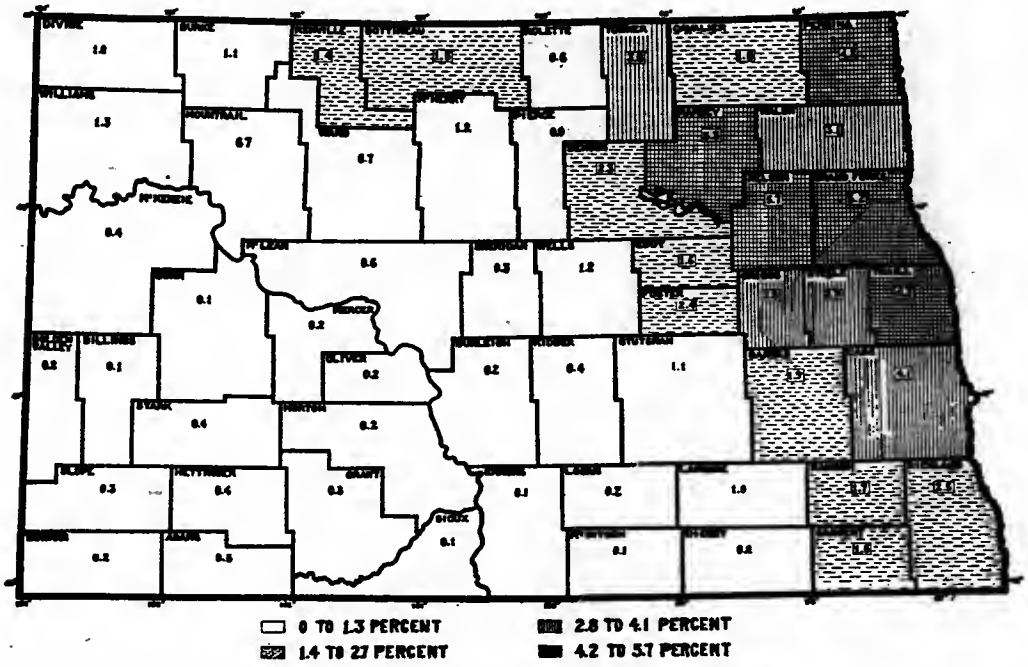


Figure 2—Percentage of sweet clover acreage by counties. Data taken from U. S. Census Bureau 1929 estimate.

Comb or Extracted Honey: It is usually well for the beginner to run his bees for extracted honey production. Later, if he so wishes, he may engage in comb honey production. Comb honey production requires much greater skill, not only in caring for the honey but in apiary management. With comb honey production it is rather difficult for the beginner to prevent swarming, whereas with extracted honey production the prevention of swarming is comparatively simple.

Equipment.

In addition to the hives of bees, the beginner's equipment should include a bee smoker, hive tool, bee veil, honey extractor, uncapping knife, capping melter, honey storage tanks, honey containers and labels. For a small number of hives a two-frame size of honey extractor will answer the purpose.

Use Modern Equipment: The beekeeper should have the standard modern hives. Nowadays it is possible to buy standard equipment from any one of several bee supply companies. Beekeepers usually find it good economy to purchase these supplies rather than to manufacture them themselves. It is also considered good economy to have foundation in all frames in the hives as this makes possible the building of straight combs having worker cells.

Care of Equipment: Proper nailing is one of the first things requiring attention. Usually the manufacturers of beekeeping equipment supply explicit directions for this. It is important to follow these directions when assembling and nailing the various parts. Afterwards the equipment should be checked over from time to time. Parts that become loose or broken thru exposure to the weather and ordinary usage should be repaired. If the nailing is properly done at the time of assembling the equipment it is seldom necessary to begin repairs on it until a number of years after it has been put to use.

All equipment exposed to the weather should be well painted. For the hives, ordinary white lead paint is commonly used. At least two coats should be applied. Only the parts of the hive exposed to the weather require painting, unless the parts are of wood or metal resistant to the action of weather. For example, the galvanized metal roof of hive covers and bottom boards made of cypress wood do not require paint.

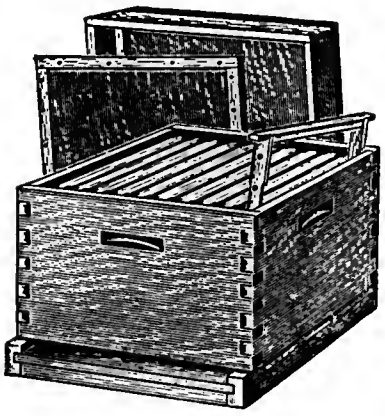


Figure 3—A modern movable frame hive. The frames require wiring and wax foundation.

The amount of service to be had from combs depends largely on the care they receive. Combs which the bees have made from frames containing full sheets of wax foundation are the best, because the use of foundation forces the bees to build the cells of worker size. When foundation is not used, the bees will build a large percentage of the cells of drone size which makes the combs practically useless.

Figure 4—A hive tool.

Wiring: All combs should be wired. The wiring strengthens the combs so that they can be handled with less breakage. The wiring also prevents stretching and distorting of the cells which occurs to unwired combs during warm weather. Wiring should be done shortly before the frames are placed in the hives and is facilitated by the use of a wiring board and wire imbedder.

Occupants of the Hive.

A normal colony of bees during the summer contains three castes of bees—the queen, the drones and the workers.

The queen is the mother of the colony and during the brood rearing season, which extends from early spring until fall, she lays many thousands of eggs in the cells of the combs. At the height of the brood rearing season, she may lay as many as 1,500 eggs per day. These eggs

require three days for hatching. The remaining stages of development require varying periods of time as given in the following table:

DEVELOPMENT STAGES.

	Queen	Drone	Worker
Egg	3 days	3 days	3 days
Larva	5½ days	6½ days	5½ to 6 days
Pupa	7½ days	14½ days	12 to 12½ days
Total	16 days	24 days	21 days

A good queen must be prolific and should transmit desirable traits such as gentleness and honey gathering qualities to her offspring.

The queen is of the same origin as the worker bee. Her specialization is brought about by a special diet, known as royal jelly, fed her during her larval period by the nurse bees.

The drone is the male bee whose sole duty is to fertilize the queen. During summer a normal colony will contain a few hundred drones. Too many drones in a colony are undesirable as they bring about congestion and crowding in the brood chamber and feed heavily on stores. Their number may be kept to the minimum by using full sheets of worker foundation in the frames of the hives. This forces the bees to build combs consisting largely of worker size cells. At the end of the honey season the drones are usually forced out of the hives by the workers. This results in their death by starvation and exposure to cold.

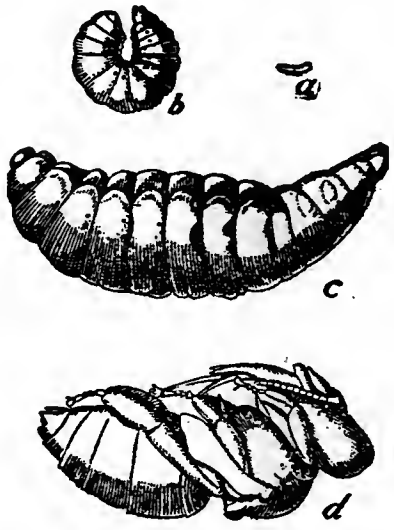


Figure 5—The honey bee. A, egg; b, young larvae; c, old larva; d, pupa. Three times natural size. From Farmers Bulletin 447, U. S. Department of Agriculture.

The worker is occasionally referred to as an undeveloped female and is the smallest individual in the hive. A normal colony will contain 20,000 or more of these individuals. In the development of the worker bee royal jelly is fed by the nurse bees only the first two days of her larval existence. After that she is given a diet of honey and pollen (bee bread). She is specialized for the various duties about the hive which include comb building, caring for the brood, guarding the hive, and collecting nectar and pollen.

Spring Management.

Spring management is not usually a serious problem for the beekeeper, provided the bees have wintered well and were given the proper attention before entering winter quarters. Spring management of the bee yard really begins in July or August when all old or failing queens should be replaced with young queens.

Moving the Bees Outdoors: If the hives of bees have been wintered in a cellar the first task in spring is to move them out to their spring location. The proper time for moving out the hives will depend some-

what on the condition of the bees and the weather. Ordinarily the hives are moved outdoors when the weather becomes fairly warm and spring-like. This is usually late in March.

When moving the hives outdoors the beekeeper should estimate the amount of honey with each colony by hefting each hive. Hives which are light in weight should be marked so that they may be supplied with the necessary stores at the earliest opportunity.

Spring Protection: To protect the bees from cold winds during spring it is desirable that they be placed on the south side of a shelterbelt of trees. The value of the shelterbelt is enhanced if it contains maples, elm and other early nectar-yielding sources for the bees.

First Examination: If colonies are weak and short of stores an early examination is desirable. Always choose a warm day for examining the bees because opening of the hives when the weather is cold will cause chilling of the brood. Do not leave the hive open any longer than is necessary to make a brief examination and to remedy any unsatisfactory conditions. Usually the first week in April is none too early to look into the condition of these colonies.

Requirements: Each hive should have sufficient bees to care for the brood and requires an adequate supply of honey, a good queen and room for her to lay eggs. If the various conditions within the hives are properly maintained, the colonies will develop strength uniformly in time to take advantage of the main honey flow.

Amount of Honey Needed: Each hive should contain the equivalent of three to four frames of honey during the early spring. If there is more than this the excess should be removed and empty combs placed in exchange. If there is a shortage of stores full combs of honey should be added to bring the stores up to the required amount.

A reserve supply of honey is needed in each hive to insure the colony a constant supply of food in case the weather is unfit for gathering from the early spring sources. These sources include elm, maple, willow, dandelion, fruit bloom and others.

Queenlessness: The condition of the brood combs is a good indication of whether or not the queen is present. Queenlessness is indicated by a lack of brood and a pollen-bound condition of the combs. A queenless colony should receive prompt attention. Probably as good a way as any to take care of the situation is to unite the queenless colony with a colony having a queen, observing the precaution to place a sheet of newspaper between the two colonies.

Hives Wintered Outdoors: Hives that have been wintered in packing cases outdoors and well stocked with honey in the fall will require but little attention until the middle of May. Then the packing material may be removed and the subsequent care will be the same as for cellar wintered hives of bees.

Package Bees: A very satisfactory method of restocking hives or making increase is by the use of package bees purchased during spring from southern shippers. These packages are sold by weight and may be had in several sizes. The two-pound package containing approximately 10,000 bees and one queen has proved most satisfactory for beekeepers in this region.

The beginner will probably find it best to have these packages arrive between May 15 and 20. The experienced beekeeper may secure package bees as early as the last week in April with most satisfactory results. Better results in honey production are secured with the earlier purchased packages because of the longer period for building up strength for the main honey flow. However, the earlier packages require more care and attention than the ones secured late. For this reason the beginner is advised to have packages arrive May 15 to 20, after the weather has become settled.

Divisions: In addition to package bees for restocking hives, other methods may be employed. The beekeeper may make divisions or nuclei

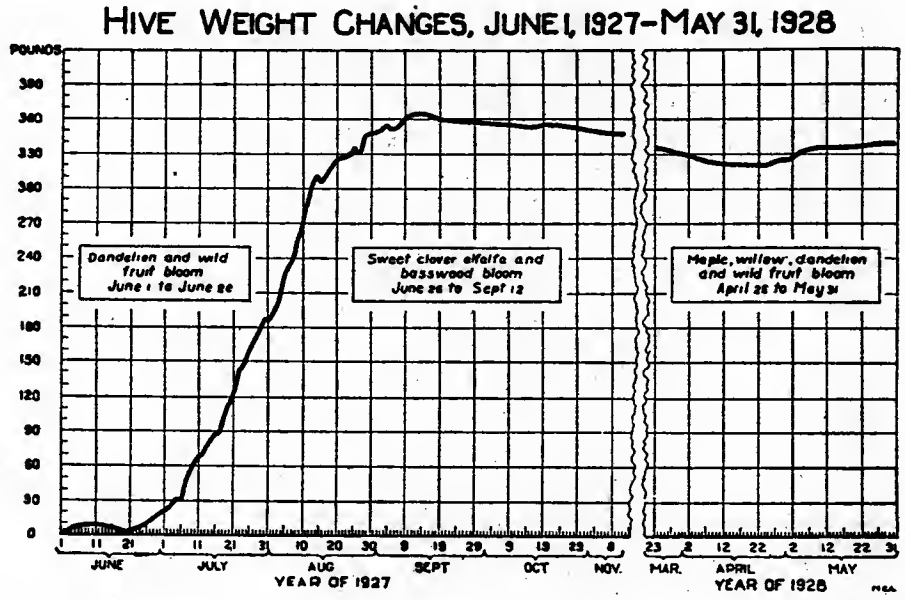


Figure 6—Changes of hive weight. Record taken at the North Dakota Experiment Station apiary, Fargo, June 1, 1927, to May 31, 1928.

by utilizing brood from overly strong colonies. This is done preferably during the latter part of May or early June.

To make a division or nucleus, place three or four combs of sealed brood containing some honey and adhering bees in a hive and fill in the remaining space with empty combs. The division should be supplied with a queen. Queens for this purpose may be secured in advance by ordering them from queen breeders located in southern states.

Under normal conditions this division will develop itself into a strong colony of bees and will store a fair amount of honey the first season. When making nuclei the beekeeper should not remove an excessive amount of brood from the parent colonies, lest they be left in a weakened condition and unable to take full advantage of the honey flow.

Swarm Prevention: Altho some strains of bees are more likely to swarm than others, a crowded and congested condition within the brood chamber is the main factor which promotes swarming. This can be remedied largely by providing adequate hive room. Additional hive bodies should be given the colony as needed.

Summer Management.

Bees require special care and attention during the summer months, the season of honey production. The main flow of nectar from sweet clover begins during the latter part of June. To take advantage of it colonies should be in uniformly strong condition.

Bee Pasture: Adequate bee pasture, preferably sweet clover bloom, is the chief requisite for bees during the summer. In North Dakota the beekeeper will usually be able to locate his apiary near fields of sweet clover or other nectar-yielding plants. Under normal conditions one acre of sweet clover, if allowed to bloom, will furnish sufficient nectar for one hive of bees.

Provide Supers: Colonies operated for extracted honey production should be provided with supers for the storage of honey at the approach of the main nectar flow and from time to time thruout the season as needed. Most beekeepers find it advantageous to place a queen excluder between the brood chamber and the supers of the hive. This device prevents the queen gaining access to the supers and facilitates the removal of the honey.

Removing the Honey: Combs that are one-half to two-thirds sealed may be removed from the hives for extraction. Before placing them in the extractor it is necessary to remove the cappings of wax from the cells. This is done most conveniently by the use of a steam heated uncapping knife. Disposal of cappings is accomplished best with a capping melter and wax separator at extracting time.

Size of Extractor: The size of extractor needed depends largely on the number of colonies in the apiary and the amount of honey for extraction. A two-frame extractor will suffice for an apiary of 25 colonies or less. Extractors are made in sizes varying from the two-frame size up to the 45-frame size.

Leave Adequate Stores: Sufficient honey should be left with the hives to provide for the bees during winter. This may be taken care of by not disturbing the honey stores in the lower two hive bodies which constitute the brood chamber. Usually enough honey will be present in a double story brood chamber to take care of the hive during the wintering period. This is especially true when there is a late flow of nectar which continues to the end of August or into September.

Comb Honey: Where colonies are operated for comb honey production the management thruout the summer will be somewhat similar to that of extracted honey production, except that swarm prevention is a more difficult problem and comb honey supers containing sections will be provided instead of extracting supers containing deep frames. The beekeeper who is particularly interested in comb honey production should study Farmers' Bulletin No. 1039 prepared by the U. S. Department of Agriculture.

Requeening: Requeening of colonies on account of old or failing queens is an important phase of the summer management of the apiary. Queens may be secured from dealers or may be reared in the owner's apiary.

The requeening should be done during midsummer. At this time the queens will have sufficient time to produce a good supply of young bees for wintering over. Late requeening is not advised because the new queen would not have sufficient time to replenish the stock of bees.

Before introducing a new queen to a hive it is well to remove the old queen. Protected by the shipping cage, the new queen may be placed in the hive until the bees are ready to accept her. Usually the bees will accept the new queen after she has been caged in the hive for a day. She may then be released. A safer method of introducing queens is by the use of "push in cages." The cage containing the queen is placed over a portion of the comb containing honey, sealed brood and empty cells. This allows the queen more freedom and greater safety than is had in the small shipping cage.

Guard Against Robbing: An important precaution is to guard against robbing among the bees. Robbing is undesirable because it endangers the health of the bees when bee disease is prevalent in the vicinity of the apiary. Robbing also demoralizes the colonies which do the robbing and causes the loss of colonies that are robbed of their stores.

Weak, unguarded colonies, or exposed honey in an apiary, are the most common causes of robbing. Honey bees instinctively secure all the honey possible while weather permits. After the nectar producing flowers have ceased to yield honey, the bees will endeavor to secure more honey at any cost. This hoarding activity, altho very desirable when nectar is available, should be discouraged when there is no nectar to be had from natural sources.

In the prevention of robbing, it is important to see to it that honey is not exposed. Some beekeepers follow the objectionable practice of exposing wet supers of combs or cappings (after the extracting season is finished) for the bees to rob out the small amount of honey they may contain. This practice not only results in damage to the combs robbed out and possible spread of disease, but it also leads to wholesale robbing among the colonies.

Once robbing has started among the colonies it is very difficult to stop. This is a case where "an ounce of prevention is worth a pound of cure."

Keep Colonies Strong: Strong colonies are a guard against robber bees especially if the hive entrances are of reasonable size. During the fall and spring when bees are not so actively engaged in the gathering of nectar and pollen, the hive entrances should be greatly reduced in size. This gives the bees a smaller space to guard and aids them in keeping the hive at a comfortable temperature.

Storing Combs: Supers of combs may be stored for the winter as they come from the extractor without the necessity of drying or removing the small amount of honey that they may contain. The main precautions to observe in regard to storing supers of combs is to place them in an unheated mouse-proof room. The combs may be protected from mice by piling the supers in tiers, one directly above the other, and covering each pile with a hive cover.

Store combs in an unheated room. This will discourage or prevent the breeding of the wax moths. The wax moth is a serious enemy both to stored combs and to weak colonies.

Sorting: Combs that become badly damaged or otherwise rendered useless should be rendered into wax. The wax may be sent to any of the larger bee supply houses for manufacturing into wax foundation or sold outright.

The Bee House: The bee house where the extracting and bottling of honey is done should be kept in a sanitary and attractive condition at all times. Public confidence demands that a high quality product, such as honey, be handled under the most favorable conditions.

Fall Preparations.

Three important points that the beekeeper would do well to observe in preparing colonies for winter are: to see that each colony is strong and provided with a queen; to leave sufficient honey with each hive; and to give proper protection during cold weather. The failure to observe any one of these points will result in winter losses.

Strength: The strength of the colony should be determined very early in the season. If a colony becomes weak because of disease, it should be burned and precautions taken to prevent spread of the disease. If, however, the weakness of the colony is due to other causes, including queenlessness, the colony should be united with a strong colony.

The usual method employed in uniting consists in simply placing the hive containing the weak colony over a strong hive. A sheet of newspaper is placed between the two which allows the two colonies to unite gradually and prevents fighting. With a little experience it is easy for the beekeeper to judge strength in a colony. A colony having a cluster of bees large enough to cover all sides of three frames is sufficiently strong for wintering.

Honey Stores: At least 45 pounds of honey should be left with each colony. This amount will be needed to carry the bees safely over until the following spring. If examination shows that some of the colonies do not have a sufficient amount of honey, the deficiency may be made up by removing empty combs and adding full combs of honey as needed.

When combs of honey are not available, feed the light weight colonies with sugar syrup until they are up to the required weight for safe wintering. Only the best grade of granulated cane or beet sugar should be used for this purpose.

For fall feeding, the syrup is usually made in the proportion of two parts of sugar to one part of boiling water (by weight). It should be stirred until all granules of sugar are dissolved. Feeding of the colonies may be accomplished by the use of tin pails having nail holes in the covers.

After the pails are filled with syrup, they may be inverted over the frames and allowed to remain until the bees have emptied them. An empty hive body should be used to accommodate the feeder pails. See that the hive cover is placed on carefully so as to exclude robber bees.

After feeding of the colonies is finished, which should not require more than two or three days, the empty hive body and feeder pails may be removed.

Placing in Cellar Quarters: Final preparation of the colonies for winter will consist in placing them in suitable quarters. If a good cellar is available the bees should be placed in it immediately after the last spell of warm weather during fall. The time for placing bees in cellars is about the middle of November.

Winter Activities: Unlike most insects in northern climates, the honeybee cluster remains active thruout the winter season. Many insects hibernate, becoming torpid or inactive at the approach of cold weather and remaining so until spring.

The honeybee prepares for its winter activities by laying up a store of heat producing food in the form of honey. This storing instinct makes the honeybee a beneficial insect to man. The honey that the bees store, over and above their needs for winter, is removed by the beekeeper as surplus honey. As much as 150 to 200 pounds or more of this "nature's best sweet" may be taken from a hive of bees in a season.

While the weather is warm the bees continue their flights, but at the approach of cold weather in the fall they remain indoors. When the temperature in the hive lowers to 57° F. the bees form themselves into a round cluster in the hive. They remain in this condition until the temperature in the hive rises above 57° F.

The purpose of the cluster formation is for the conservation of heat. The bees on the outside act as insulators and on becoming chilled they change places with the warmer bees within. As the air surrounding the bees becomes colder, the cluster becomes more compactly formed and the bees on the outside change places with those inside the cluster more rapidly.

Honey, A Heat-Producing Food: Without a heat or energy-producing food such as honey the cluster of bees could not maintain this activity.

Protection: The bees become more active and increase expenditure of energy as the surrounding air becomes colder. This is why protection in the form of good cellars or winter packing cases is recommended for the wintering of bees.

Protection which keeps the colony comfortable during the cold weather will repay the beekeeper two ways. First, it will save in the amount of honey consumed. A hive of bees protected from the cold weather will expend but little energy and consequently will eat much less honey than an unprotected hive of bees. Second, protection will conserve the energy of the bees within the hive and thereby lengthen their lives.

The life of a bee has appropriately been compared to the life of a dry cell battery—the more rapidly its energy is expended, the shorter its life will be. If exposure to cold forces the bees to work hard during winter to keep themselves warm, they are likely to die outright. Even if they do winter thru they will be in a weakened state and not able to carry on in spring.

Winter Care of Bees.

Bees require special care during the winter if they are to reach spring in the desired condition. The attention to be given them by the owner will depend largely as to whether the bees are wintered in a cellar or in packing cases outdoors. With either type of wintering a liberal supply of stores of the best quality is important.

For cellar wintering of bees most beekeepers in North Dakota consider a cellar temperature of 43° F. ideal. At this temperature bees appear to be very quiet and contented. Cellar temperatures two or three degrees above or below 43° F. causes no appreciable harm but wider fluctuations of temperature are harmful.

A cellar that becomes too cold for proper wintering of bees is not properly insulated against outdoor weather changes. The usual type of basement cellar underneath houses seldom gets too cold. A cellar that is too warm can usually be remedied by providing adequate ventilation.

Ventilation: If the usual ventilating system is inadequate it may be necessary to cool the cellar by opening a door or window. This however, should be done at night. If done during the day the light admitted will disturb the bees. The cellar should be kept as dark as possible at all times, altho it has been found that red light, the kind used in photographic work, apparently does not disturb the bees.

Bee Diseases.

The beekeeper should be familiar with the literature on bee diseases so that he will be able to recognize the diseases and apply proper control measures whenever the occasion demands. There are three brood diseases, common only to the honeybee, all of which attack bees in the larval stage. They are American foul-brood, European foulbrood and sac brood.

American foulbrood is the most serious of all and has been found in a number of apiaries of the state. European foulbrood is not known to be present in North Dakota. Sac brood is commonly found in many apiaries, especially during early summer and occasionally causes serious loss.

American Foulbrood: American foulbrood is caused by a spore-forming bacteria, *Bacillus larvae.* It is the most destructive of all brood diseases. Unless definite measures are taken by the beekeeper in controlling this disease, it will result ultimately in the death of the entire colony. Furthermore, it will provide a source of spread for the disease *because a colony weakened by American foulbrood cannot defend itself against robber bees coming from healthy colonies.* These robber bees remove honey from the infected hive to their own, thereby spreading the disease.

Usually the symptoms of American foulbrood are not noticed until the disease has reached a fairly advanced stage. At this time a large portion of the worker brood cappings will be *perforated* and the con-

tents of each diseased cell will contain a dead larva. Some of the larvae may be just recently dead of the disease and others may have been dead

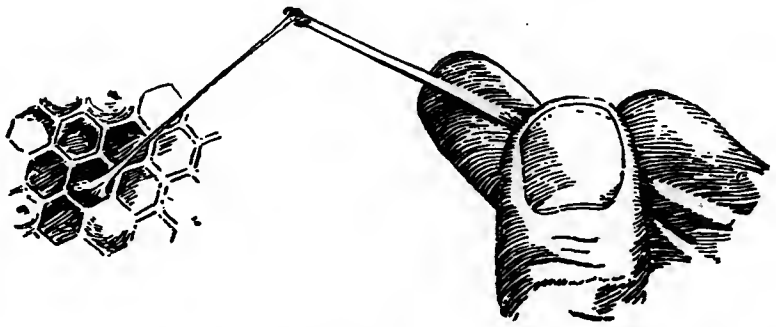


Figure 7—Ropiness of American foulbrood. From Farmers' Bulletin 1084, U. S. Department of Agriculture.

for some time. Each larva or grub dead of American foulbrood assumes a uniform flattened position on the base of the cell.

Healthy larvae are pearly white in color but when they die of American foulbrood they gradually change to a brown or coffee brown color. Shortly after the larva dies of this disease it assumes a *gluey* or *ropy consistency* and its adherence to the base of the cell becomes very pronounced.

This gluey consistency is best seen by inserting a toothpick into the diseased larva. Upon withdrawing the toothpick some of the contents will rope out rather thread-like.

Later, when the diseased larva dries down, it will harden and adhere tightly to the cell wall. In this state it is spoken of as a scale and it cannot be removed except by damaging the cell wall.

Hives affected with American foulbrood should be burned.

European Foulbrood: European foulbrood is caused by *Bacillus pluton*, a non-spore forming bacteria. This brood disease is not known to be present in North Dakota. Where present in other parts of the country the disease is usually found in weak colonies and usually accompanied by a poor honey flow. In localities where European foulbrood is present it is found early in the season, especially in colonies of black or hybrid bees. Frequently it will disappear of its own accord when the honey flow becomes satisfactory.

Sac Brood: Sac brood is caused by a filterable virus. This brood disease occasionally causes an appreciable loss to beekeepers. Sac brood has been known for many years. The disease is infectious and is transmitted by the nurse bees while feeding the young larvae.

Ordinarily the larvae die after the cell is sealed. Often the bees remove the capping, making it appear the larva died before the cell was capped. The early symptoms of sac brood in the larva is a swollen appearance of the whole body.

The larva gradually changes to a watery gray color and assumes a sac-like appearance with the head end turned up gondola-like towards the cell opening. The head end soon becomes dark in color. On account

of the sac-like condition of the diseased larva, it can be lifted out of the cell intact.

Requeening of the affected colony with a young vigorous queen is considered a satisfactory control. Usually a colony recovers very rapidly under the stimulation of a new queen and especially so if accompanied by a good nectar flow.

The Greatest Value of Bees.

The value of the honeybee as a pollinating agent of sweet clover has been shown by Dr. J. H. Shepperd in Bulletin 211, Sweet Clover Experiments in Pasturing, North Dakota Experiment Station. In this bulletin Dr. Shepperd points out that the honeybee while collecting nectar from the plants incidentally carries pollen from blossom to blossom, which results in proper formation of the seed. Citing a number of practical experiments he shows that honeybees increase the yield of sweet clover seed over 100 per cent and by that means probably improve its pasture value. He states that the seed formed on sweet clover plants seems to add to the fattening and milk production of cattle grazed on that crop. As the distances increased between the fields of sweet clover and the bee yards, the production of sweet clover seed was decreased. The greatest benefit from the activities of honeybees was apparent on fields within a one and one-half mile radius of the bee yards.

Dr. E. F. Phillips of Cornell University makes the following statement concerning the value of the honeybee in the orchard: "Many species of insects visit fruit blossoms and carry pollen from flower to flower. Of these insects, none work more industriously than do honeybees. Some of the species of small wild bees that fly rapidly from flower to flower and work actively are usually rare at the time of fruit bloom. Intense cultivation reduces the places where these wild species hibernate and nest. In the spring when these insects are needed, they are usually few in number and have not had sufficient time to replace winter losses. For many species only fertile females live over winter. Honeybees also suffer winter losses, but skilled beekeepers now know how to reduce these losses. Since the honeybee is the only insect that can be brought to the orchard when needed and may, if desired, be removed when not needed, and since any number of colonies may be introduced, it is the only insect that may be used for assurance of pollination. The importance of its use cannot be too strongly emphasized."

Bees render their greatest service as agents of cross pollination for crops and fruits. The value of this to the farmer and fruit grower is even greater than the value of the honey and wax to the beekeeper.

RED-CLOVER POLLINATION BY HONEYBEES IN COLORADO.

(By R. G. Richmond.*)

Reports have been current in the Rocky Mountain region, of large yields of seed from red clover *(Trifolium pratense* L.*)*. Some of these reports have come from the irrigated strip of land bordering on the Arkansas river in Colorado, and chiefly from the vicinity of Rocky Ford. Yields have been known to exceed 14 bushels of seed per acre and to reach even 18 bushels. This yield is obtained from two cuttings per year. By far the greater seed crop is reported from the first cutting.

Accompanying these reports of large yields, comes information that honeybees have been very prevalent on the blooms, indicating that they have possibly had a part to play in the setting of the large seed crops.

In view of these stories of large seed crops, it was decided to investigate the role of the honeybee *(Apis mellifica* L.*)* in red clover pollination at various points in the state.

Review of Literature.

In an article by the writer (19), attention was directed to the dearth of bumblebees and the large number of honeybees on the first crop of red clover, in Colorado.

It was also mentioned that little nectar seemed to be present in the florets.

Reference has been made by other writers, to the yields of seed in other localities, with speculations, in some cases, as to the cause of the variation of seed yield. Aicher (1) points to exceptionally heavy yields reported from various points in Southern Idaho. These reports indicate seed crops of from 9 to 15 bushels per acre. It is not mentioned by this author if the reported yields are from one or two cuttings. Other authors less optimistic, refer to the usually light yields from the first crop. Hunter (12) says experience has taught the clover-seed producers that the first crop, especially that of red clover, yields a very small quantity of seed if allowed to mature naturally. Martin (14) speaks of the usually poor seed production in the early part of the season. Hunt (11) bears out the opinion of Martin, in a statement that,

"The most abundant seed is obtained from plants that do not grow so large as to be blown down or become decumbent on account of their great weight. This dry soil is therefore most suitable to the seed crop. Throughout

* Deputy State Entomologist, and Associate in Entomology Section of The Colorado Experiment Station. This study was financed largely by funds from the Office of State Entomologist.

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Figure 1—A normal field of red clover in Colorado.

the North Atlantic and North Central states, only the second crop is cut for seed, since the first crop seeds less abundantly than the second. Two reasons for this have been offered. First, since the second crop is not so luxuriant as the first, it is less likely to fall down from wind and otherwise; and second, the first crop is usually harvested before bumblebees become abundant. The writer had a late blooming first crop examined, bumblebees having by that time become common, and found an abundance of seed."

Hopkins (10) observes that there may be as much seed set in the first crop as in the second.

Noting another angle of the extent of seed production, Hollowell (9) points out that it must be borne in mind that under field conditions an average of 25 seeds per head is considered to assure a fair seed crop.

Work has been presented showing the effect of atmospheric and soil-moisture conditions during pollination and setting of seed. Aicher (1) observes that pollination and fertilization take place most rapidly when blossoms are dry and when the atmosphere is both dry and warm. Hollowell (9) after conducting some hand-pollinating experiments notes that the results show that high atmospheric moisture in both field and greenhouse did not limit the setting of red-clover seed. Martin (14) speaking of conditions modifying the amount of water delivered by the stigma having an effect on fertilization says,

"This may account for the usually poor seed production in the early part of the season, since there is usually more moisture in the ground at this time and more rain during the flowering period than occurs during the second crop." This author does not state if insect pollinators are as plentiful on the first as on the second crop and the first seed crop is inferior in quantity to the second, the problem may be physiological, otherwise it would appear to be entomological.

Many demonstrations have been made as to whether red clover be self sterile or otherwise. It will suffice to mention representatives of these. Cook (6) covered 10 heads of red clover with cheesecloth to prevent insect visitation. No seed set, while on 10 other uncovered heads of the same age, 191 seeds set. Bolley (5) investigating the same point, screened a large area of red clover with wire screen of so small a mesh that nothing larger than a mosquito could well penetrate. Only one red-clover head produced seed and that but one or two kernels. Beal (3) found a few seeds in caged heads during each of his 8 years' observations. Westgate and Coe (25) showed why red-clover flowers are almost completely self sterile.

Much has been written on the value of bumblebees as pollinators of red clover. Rott (20) comments that as agents in the pollination of flowers, bumblebees are second only in importance to honeybees. Many flowers are adapted wholly to their visits. Several flowers, including red clover, are mentioned by this author. Washburn (26) proved that bumblebees pollinate red clover. Waldron (23 and 24) concludes that bumblebees are responsible for about 95 percent of the red-clover seed produced. Pammell and Kenoyer (16) did not place much confidence in the honeybee as an effective pollinator under all circumstances.

Schneck (21) states that *(Xylocopa virginica),* the Virginian carpenter bee, slits the corolla tube of red-clover flowers to obtain the nectar. This author also avers,

> "I have repeatedly observed the honeybee (*Apis mellifica* L.) visit all these plants, and it apparently prefers to take the nectar through the slits that have been made by the carpenter bee; but when it does not find a slit already made it then goes to the mouth of the tube and visits the flower in the usual way, by entering the mouth of the tube."

It is said that nectar is freely secreted by red clover. This conclusion has been so general in acceptance that, some years ago, efforts were made to select and breed a race or strain of honeybees of tongue length adequate to make red-clover nectar readily accessible. Pammell and Kenoyer (16) observed that on pulling the red-clover flower out of the calyx, the nectar is visible to the naked eye. Pellett (18), discussing nectar secretion in red clover, observes that there is no question but that the plant secretes nectar in abundance. The same author quotes many beekeepers who insist that they have secured varying crops of red-clover honey. However, no conclusive evidence is put forth that the honey in question was from red clover. Too, this author's statement, regarding the abundance of nectar in red clover, does not necessarily apply to all localities where the plant grows commercially.

Referring to previous comment on the tongue length of honeybees, it is noted that comparisons have been made between tongue length of honeybees and the length of the corolla tubes in red-clover flowers. In respect to tongue length, Mikhailoff (15) reports some biometry of the honeybee, quoting several Russian investigators. The longest tongue found by any was 6.875 mm., including mentum, submentum and ligula (glossa). The average length of proboscis found by this author was 6.6023 mm. Alpatov (2), measuring 15,000 bees, finds few with longer tongues than those mentioned by the previous author. The longest-tongued bees found in the United States were the Caucasians of Colo-

rado. No variation in tongue length was found from south to north, due apparently to their conglomerate origin. It is well to note here, that few of the bees in the Arkansas Valley are of other than the ordinary Italian cross of the state. Gillette (7), speaking of measurements of tongues of 230 bees from various parts of the country says,

"I shall have to conclude that, so far as my study of the subject has gone, there has been no indication of any strain of common honeybee worthy of the distinction long-tongued. These measurements do not disprove that there may be strains of bees that work more fully than others upon red clover."

Going further and comparing the length of the corolla tubes and the length of the bees' tongues, this author wonders if it is possible that those who think bees have gathered honey from red clover can be mistaken, and that they visit the blossoms of this plant for pollen only. At the time of this author's investigation, breeders were advertising queens which were supposed to produce a long-tongued or red-clover strain of bees.

Procedure.

In investigating this problem, it seemed logical to ascertain first if bees, working on red clover, were carrying pollen. While casual observation proved that pollen was carried, determination of the percentage of bees with loads of pollen was thought advisable. Also, some notation was made regarding the tendency of bees to carry pollen and nectar on the same fielding trip.

At the outset of the problem, efforts were made to discover if honeybees were a major or a minor factor in red-clover pollination at Rocky Ford. Cages were made of screen wire to cover plots of clover for different purposes. The screen used was of 13 meshes to the inch, adequate to prevent the passage of common honeybees or bumblebees.

A large cage, 20 feet by 10 feet and 10 feet high, was constructed to include a colony of honeybees. This cage was placed before clover-blooming time, or if blossoms were present, they were plucked before the bees were placed in the cage. The bees were left in the cage during the large part of the blooming period. (A colony, in such a position, rapidly loses its strength and should have a frame of capped brood added as needed.)

Smaller cages, 5 feet by 5 feet and 2.5 feet high, were made and placed over areas not yet in bloom or from which the blooms were plucked. These cages were used to exclude all insects unable to penetrate the screen above mentioned.

Another pair of cages, 6 feet by 6 feet and 34 inches high, were put in operation at Fort Collins. These were used to determine the pollinating effect of night-flying insects. The plots, covered by these cages, were uncovered, one during the day and one during the night, during part of the major blooming period.

At a later date, seed counts were made from the flowers in the cages and in the open field. Analyses were made of the seed to test its viability and to demonstrate the type of seed counted. To check the percentage of seed set per flower, counts were made of the number of flowers per head. The general condition of the flowers was observed as

to the ideal pollinating time, whether it be before flush pollinating time, at time of flushest bloom, or during the early withering stage of the corolla. Notes were made as to the presence of nectar and regarding the length of the corolla tube.

It was thought that there might be competition between red clover and other plants for the attention of insect visitants. Gubin (8), reporting on the work of Klingen and Lisitzin, states that these workers conclude that the successful fertilization of red clover depends on: First, the absence at the moment of the blooming of the red clover of any competition with other nectar-secreting plants, and second, the cultivation of long-tongued Caucasian bees. Information was sought to determine if the presence of alfalfa in bloom, seemed to detract from the attention of bees to red clover, alfalfa being the main bee plant in flower during the early part of the first cutting red-clover bloom. Clover heads, which had bloomed and browned before alfalfa started, were tagged. Some, in flush bloom just before alfalfa was cut, were marked. Seed counts were made from these heads at maturity.

Observations.

Bees Carry Red-Clover Pollen.—Honeybees were collected from a red-clover field by two methods. A sweeping net was used to collect a few but was discarded. The danger of collecting bees with pollen loads from other plants, was recognized. Hand picking of bees from clover heads was thought more accurate. In a collection of 111 bees, 104 or 93.7 per cent were found, upon microscopic examination, to have pollen in their baskets. In another group of 66 bees, 65 or 98.5 percent were carrying pollen. These bees were taken as noted on the clover heads and without selection. The high percentage of bees with pollen in their baskets seems remarkable, in that some bees are constantly coming and going to the hive. Too, some bees escaped the operator in his effort to apprehend them. Possibly these bees were less loaded and more able to make a speedy escape than those which carried loads. But, since a small percentage escaped, the error in the above figures is slight. It is well to note, regarding pollen-carrying bees, observations by Soudek (22), who says,

"The bees seemingly after they become collector they start first with collecting pollen and later with nectar and water."

The remark of this author would seem to be borne out by the observations of the writer, as mentioned above. The large percentage of bees carrying pollen was not because of a dearth of nectar, as a colony within one-half mile averaged 3.4 pounds per day net gain, from sweet clover and alfalfa, over a period of 10 days at the time the bees were taken on the red clover.

It is not the intention of the writer to imply that bees do not carry nectar and pollen at the same time. The facts are to the contrary. The work of Soudek (22) does not state that bees adhere rigidly to one job at one time, but indicates that there is a tendency so to do. Observations by the writer showed that bees were carrying large loads of sweet-clover nectar and also loads of pollen. Lazenby (13) states that he has

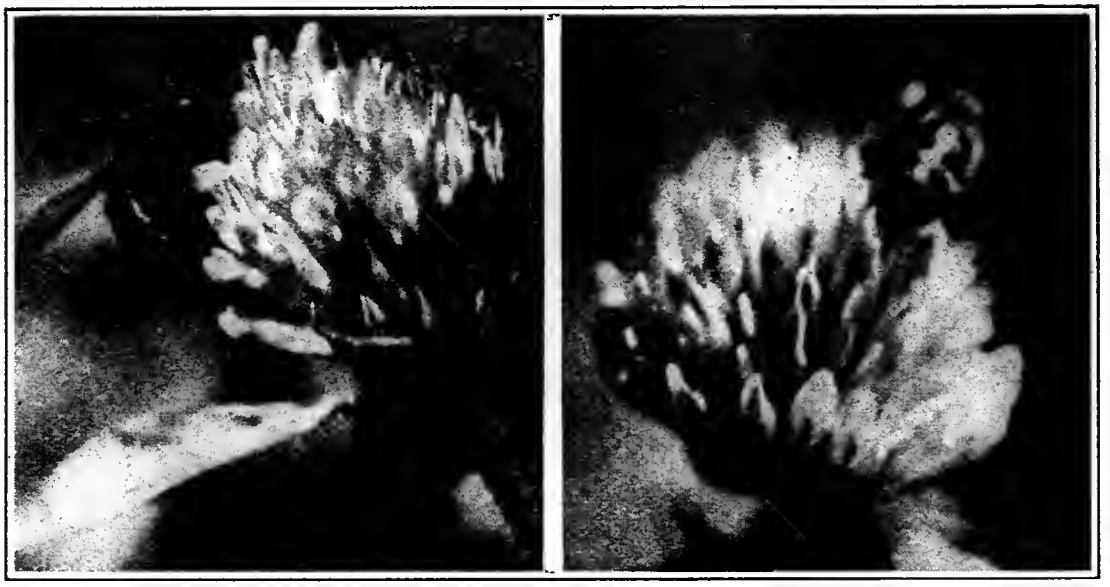

Figure 2—Honeybees at work pollinating red clover. Note the pollen on the legs in the picture to the right.

killed scores of pollen-bearing bees just as they were entering the hive and has never found one loaded with more honey than one is likely to find in any worker bee when it leaves the hive. This author does not state what plants were in bloom at the time or if any honey flow was in progress during the investigation.

While it may be questioned that the pollen on these bees was from red clover, it probably was from that source. Betts (4), after careful examination of about 1500 pollen samples, found that 6.75 percent were loads of two or more kinds of pollen. This finding corresponds closely to that of another investigator whose work is as yet unpublished. It is also pointed out by Parker (17) that honeybees are specifically constant in their pollen gathering.

It should be borne in mind that, during this investigation, bees were very plentiful on red clover. During the first-crop blooming-time they were found, on sweeping with a net, to outnumber the bumblebees more than 100 to 1. Casual observations, in undisturbed areas of clover, bear out this ratio. Pollen seemed very plentiful and was carried in large loads. The abundant supply of pollen in red clover is mentioned by Hopkins (10).

Bearing in mind these observations and noting information in a later part of this paper, it seems well to question here, the reason for the visit of the honeybee to the red-clover flowers. According to Parker (17), *Trifolium pratense* is listed as a plant from which "pollen only" was secured. Do the bees find therein a source of pollen more convenient than elsewhere? Some other localities have a poor set of seed in the first crop according to Hunter (12) and Martin (14). Can it be that, in such localities in some seasons, there are sources of pollen more desirable or more accessible than are furnished by red clover? Under Colorado conditions, the theory presented in these questions seems more tenable than any presented thus far. It would seem logical that the presence

or accessibility of nectar need not be the factor which governs the visits of the bees to red clover any more than the availability or desirability of various sources of pollen. It seems as logical that bees would seek out pollen, in case of need, just as they hunt for nectar when it is needed. Evidence to corroborate this opinion is found in the fact that honeybees visit freely staminate flowers.

Cages Govern Pollinators.—The large cage, as described under procedure, had a colony of ordinary honeybees placed therein late in May, when the clover blooms were well advanced. Most of the field bees (pollen and nectar gatherers) flew to the screen and did not return to the hive. These bees took little, if any, part in the pollination of the caged clover blossoms. The colony was distinctly weakened by these fielders being lost. Despite the weakened condition of the colony a good set of seed was obtained. Five hundred heads were picked from the cage the first week in July. Fifty heads were taken at random from this group and threshed. Care was taken to discard any head that had been damaged in picking or shipping. These fifty heads yielded 3077 seeds or 61.54 seeds per head. Only plump, undamaged seed was counted. A small percentage of seed was lost in all counts due to clover seed chalcid *(Bruchophagus funebris* How.) injury. The maximum number of seeds from one head was 133 and one seed was the minimum.

From the small cages, used to exclude insects, 500 heads were picked and treated as those above mentioned. From this group 100 heads were taken and were found to contain 49 seeds, an average of .49 seeds per head. It is possible that these seeds came from heads which had grown against the screen of the cage. Bumblebees had been observed at work on such heads thru the screen.

From the open field, where pollinators could visit at will, 200 heads of clover yielded 13,452 seeds, an average of 67.26 seeds. In another group of 150 heads, 13,984 seeds averaged 93.23 seeds per head. These records are from two seasons.

Similar results to the above were obtained by Mr. Justus Ward in 1928. No seed set where pollinators were excluded, .0729 grams per head were secured from honeybee pollination and .0728 grams per head resulted from open-field pollination. Mr. Ward was at that time in charge of the Colorado Experiment Station farm at Rocky Ford and conveyed this information by letter.

The above mentioned yield of seed per head verifies the reports of large crops, since, according to Hollowell (9), 25 seeds per head assures a fair seed crop.

Competition Among Plants for Insect Visitants.—Determination was made to see if there was competition among plants for the attention of pollinators. Alfalfa and sweet clover are much in favor with honeybees and are very prevalent. A group of 102 heads of clover, which had bloomed and dried before alfalfa flowered, yielded 6411 seeds, an average of 62.84 seeds per head. Another group of 98 heads, flowering during the alfalfa bloom, yielded 7041 seeds, an average of 71.84 seeds per head. A third lot had been tagged for later study and were picked at harvesting time, but the seed was immature and not countable. From this, it

TABLE 1—SHOWING COROLLA MEASUREMENTS IN MM., FLOWERS PER HEAD AND SEED SET PER HEAD, IN FIELD NO. 1, AT ROCKY FORD, 1927.

Corolla measurements.						Flowers per head.				Seed set per head.			
Head No.	Tube length 1	2	3	Flower No. 4	5	Head No.	Flowers	Head No.	Flowers	Head No.	Seed	Head No.	Seed
1.	11	11.5	12.5	12	10.5	1.	101	26.	119	1.	100	26.	129
2.	11	10.5	10.5	11	10	2.	100	27.	96	2.	134	27.	80
3.	10	10.5	9.5	10	10	3.	99	28.	78	3.	122	28.	82
4.	9.5	9.5	9.5	10	10	4.	115	29.	73	4.	123	29.	118
5.	10	10	10	10	10	5.	118	30.	103	5.	91	30.	96
6.	10.5	10.5	10.5	10	10	6.	81	31.	161	6.	70	31.	105
7.	10	9.5	9	9.5	10	7.	97	32.	133	7.	36	32.	111
8.	11	11	11	11	11	8.	119	33.	109	8.	78	33.	103
9.	11	11	11.5	11.5	11	9.	97	34.	80	9.	109	34.	77
10.	11	11.5	10.5	11	11	10.	119	35.	102	10.	101	35.	123
11.	11.5	11.5	11.5	11.5	11.5	11.	119	36.	66	11.	37	36.	63
12.	10.5	11	10.5	10.5	10.5	12.	117	37.	119	12.	130	37.	95
13.	10.5	10.5	11	11	11	13.	70	38.	101	13.	89	38.	71
14.	11	10.5	10.5	11	11	14.	92	39.	80	14.	70	39.	55
15.	10	10	9.5	10	10	15.	76	40.	88	15.	100	40.	71
16.	10.5	11	10.5	10.5	11	16.	86	41.	114	16.	100	41.	68
17.	11	11	11.5	11.5	11.5	17.	73	42.	86	17.	83	42.	73
18.	10	10	10	10	10	18.	109	43.	74	18.	126	43.	109
19.	12	12	12	12	12	19.	102	44.	100	19.	81	44.	91
20.	10	10	10.5	10.5	10.5	20.	110	45.	125	20.	61	45.	68
21.	10.5	10.5	10.5	10.5	10	21.	118	46.	83	21.	84	46.	78
22.	10.5	10	10.5	10.5	9.5	22.	99	47.	97	22.	71	47.	65
23.	11	11	11	11	11	23.	128	48.	74	23.	105	48.	89
24.	10	10	9.5	10	10	24.	78	49.	120	24.	68	49.	79
25.	11	11.5	11.5	11	11	25.	84	50.	135	25.	89	50.	91
Mean	10.6±.04 mm.					Mean	100.46±1.87			Mean	88.96±2.2		
Max	12.5 mm.					Max	161			Max	134		
Min	9.0 mm.					Min	66			Min	36		

TABLE 2—SHOWING COROLLA MEASUREMENTS IN MM., FLOWERS PER HEAD AND SEED SET PER HEAD, IN FIELD NO. 2 AT ROCKY FORD, 1927.

Corolla measurements.						Flowers per head.				Seed set per head.			
Head No.	Tube length 1	2	3	Flower No. 4	5	Head No.	Flowers	Head No.	Flowers	Head No.	Seed	Head No.	Seed
1.	9.5	10	10	10	10	1.	113	26.	92	1.	111	26.	134
2.	9	9.5	9.5	9	9.5	2.	107	27.	118	2.	166	27.	100
3.	10.5	10.5	10	10.5	10	3.	150	28.	112	3.	109	28.	119
4.	9.5	9.5	9.5	9.5	9.5	4.	78	29.	115	4.	79	29.	73
5.	10	10	10	10	10	5.	119	30.	140	5.	78	30.	90
6.	10	10	10	10	10	6.	99	31.	128	6.	78	31.	88
7.	10.5	10.5	10	10.5	10.5	7.	123	32.	112	7.	77	32.	96
8.	10.5	10	10	10	10	8.	106	33.	127	8.	133	33.	88
9.	10.5	11	11	11.5	10.5	9.	121	34.	101	9.	78	34.	73
10.	10.5	11.5	11	11	11	10.	127	35.	116	10.	105	35.	88
11.	10	10	10	9	9	11.	120	36.	130	11.	63	36.	133
12.	10	10	10	10	10.5	12.	83	37.	139	12.	117	37.	119
13.	9	8	9	9	9	13.	111	38.	119	13.	101	38.	121
14.	10	10	10	10	10	14.	95	39.	100	14.	70	39.	83
15.	9	9	9	9	9	15.	129	40.	87	15.	128	40.	113
16.	10	10	10	10	10	16.	137	41.	103	16.	109	41.	110
17.	11	10.5	11	11	10	17.	162	42.	122	17.	86	42.	86
18.	10	10	10	10	10	18.	124	43.	116	18.	99	43.	95
19.	10.5	10.5	10	10.5	10.5	19.	105	44.	92	19.	102	44.	112
20.	10.5	10.5	10.5	10	10	20.	86	45.	107	20.	112	45.	110
21.	10	10	10.5	10	10	21.	122	46.	126	21.	118	46.	116
22.	9.5	9.5	10	9.5	9.5	22.	101	47.	130	22.	107	47.	109
23.	10	10	10	10	10	23.	115	48.	118	23.	66	48.	109
24.	10	10	10	9.5	10	24.	108	49.	109	24.	72	49.	83
25.	10	10	10.5	9.5	10	25.	106	50.	105	25.	94	50.	78
Mean				10.63±.023 mm.		Mean			114±1.63	Mean			99.68±1.94
Max				11.5 mm.		Max			162	Max			166
Min				8.0 mm.		Min			78	Min			63

TABLE 3—SHOWING COROLLA MEASUREMENTS IN MM., FLOWERS PER HEAD AND SEED SET PER HEAD, IN FIELD NO. 3, AT ROCKY FORD, 1927.

Corolla measurements.						Flowers per head.				Seed set per head.			
Head No.	Tube length 1	2	3	Flower No. 4	5	Head No.	Flowers	Head No.	Flowers	Head No.	Seed	Head No.	Seed
1.	10	9.5	9.5	10	10	1.	110	26.	172	1.	72	26.	92
2.	11	10.5	10.5	10.5	10	2.	84	27.	125	2.	98	27.	89
3.	9.5	9	9	9	9.5	3.	160	28.	135	3.	68	28.	87
4.	10	10	10	10	9.5	4.	96	29.	140	4.	123	29.	70
5.	9.5	10	10	9.5	9.5	5.	97	30.	116	5.	69	30.	82
6.	9.5	9.5	10.5	10.5	10	6.	108	31.	84	6.	95	31.	83
7.	10	10	10	10	10	7.	148	32.	127	7.	82	32.	83
8.	10	10	10	10	10	8.	118	33.	121	8.	56	33.	140
9.	9.5	9.5	9.5	10	10	9.	83	34.	114	9.	92	34.	147
10.	9	9.5	10	10	10.5	10.	116	35.	115	10.	97	35.	95
11.	9	9	9	9	8	11.	94	36.	116	11.	101	36.	77
12.	10	10.5	10	10	10	12.	110	37.	123	12.	101	37.	66
13.	9	9.5	9	9	9	13.	122	38.	148	13.	83	38.	137
14.	10	10.5	11	10.5	10.5	14.	108	39.	104	14.	86	39.	81
15.	10.5	11	11	11	11	15.	125	40.	148	15.	92	40.	84
16.	9	9	9.5	9.5	9.5	16.	159	41.	115	16.	90	41.	92
17.	10	9	9.5	10	10	17.	133	42.	120	17.	146	42.	95
18.	9.5	9.5	9	9	8	18.	132	43.	86	18.	69	43.	73
19.	10	10	9.5	9.5	9.5	19.	118	44.	130	19.	97	44.	80
20.	10	10	10	10	10	20.	149	45.	106	20.	93	45.	93
21.	10	10	10	10	10	21.	119	46.	117	21.	71	46.	95
22.	9.5	10	10	9.5	10	22.	93	47.	124	22.	82	47.	93
23.	10	10	10	9.5	9.5	23.	90	48.	147	23.	115	48.	82
24.	9.5	9.5	9.5	9.5	9.5	24.	133	49.	112	24.	131	49.	92
25.	10	10	10	10	10	25.	102	50.	112	25.	45	50.	92
Mean			9.79±.033 mm.			Mean			119.28±1.93	Mean			91.04±2.02
Max.			11 mm.			Max			172	Max			147
Min			8 mm.			Min			83	Min			45

appears that alfalfa was not a successful competitor for the attention of the pollinators of red clover in this instance. Sweet clover was not in advanced-blooming stage at the time. Honeybees do not secure pollen, in quantity, from alfalfa.

Night Pollinators.—As previously mentioned, night pollinators were considered. Cages were removed from the plots for this study, just before daylight and just after dark. It was found that bumblebees are active at sunrise and after sunset. The long work hours of these insects may have allowed a slight error to creep into the calculations of seed set in the night-exposed plot. It was discovered that bumblebees work very early and only one occasion for such possible error was permitted. This observation does not agree with that of Gubin (8) who mentions that the honeybee starts its work earlier in the morning than the bumblebee. The observation by this author is questioned, in view of the fact that some bumblebees remain in the field over night and are ready to go to work as soon as the air warms up in the morning. All flowers in pollinating condition, when the cages were set in place, were picked. The cages were adjusted and 10 days allowed to elapse. By that time many blooms were in prime pollinating condition. The plots were then covered and uncovered alternately night and morning for 7 days and 7 nights. It was noted that in the daylight-exposed plot, after 2 days exposure, many of the heads showed drying corolla tubes. In the other cage, the tubes remained fresh for a much longer time. This observation was made also by Westgate and Coe (25).

After 7 days, the plots remained covered until enough heads were ripe and dry. These first dry heads were plucked from both cages and threshed. In picking, care was taken to select only the oldest appearing heads. From 109 heads, exposed in the daylight, 7371 seeds were taken,

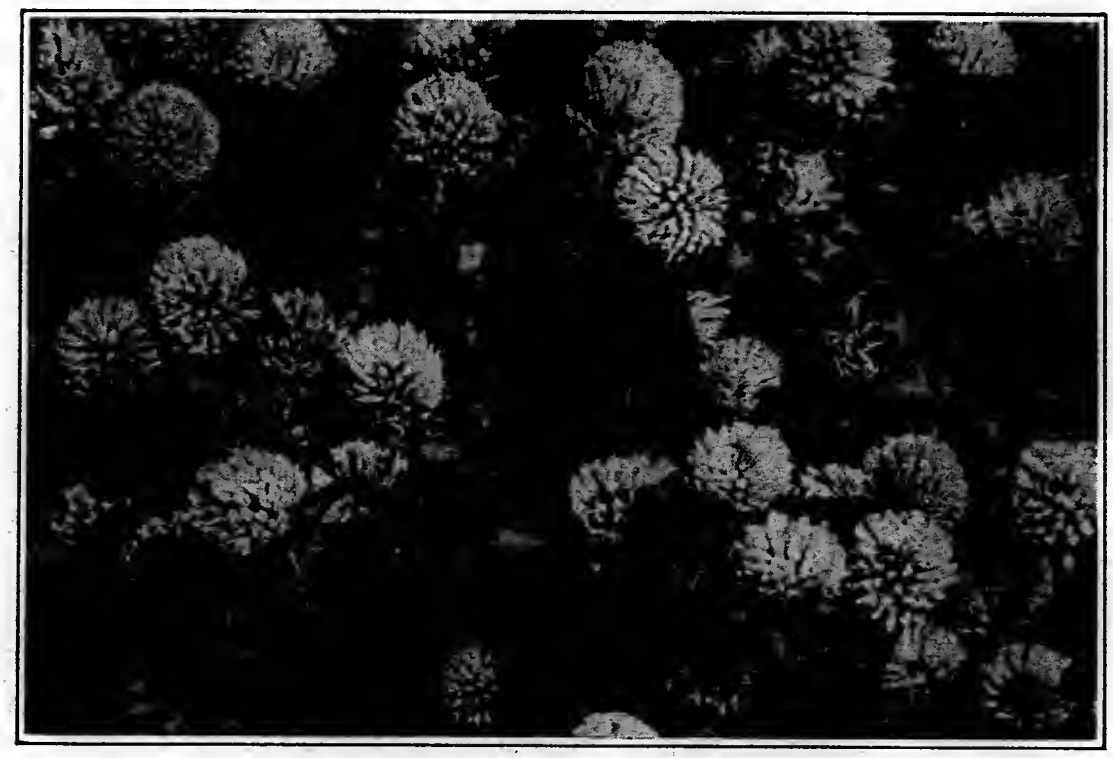

Figure 3—Caged blossoms remain fresh longer than those in the open field.

Figure 4—The corollas of pollinated flowers soon wither and die. These flowers are of the same age as those in Figure 3, in the same field and side by side.

an average of 67.623 seeds per head. In 100 night-exposed heads, 99 seeds set, an average of .99 seeds per head. One-half of the seeds set in the night plot occurred in 5 heads, 75 having no seed at all. A bumblebee was busy on this plot for a few minutes prior to the first day's change of cages, which was just a few minutes late. Other investigators, however, have found a few seeds set in cages where insects were excluded. Beal (3) mentions that during 8 years he covered clusters of flower heads of red clover and never failed to secure some seed.

The following summary of seed set under different conditions is evidence of the part played by the honeybee as a red-clover pollinator.

TABLE 4—SHOWING SEED SET UNDER DIFFERENT CONDITIONS.

Flower treatment.	Number of heads.	Seed set.	Average seed per head.	Maximum seed per head.	Minimum seed per head.
Cage with bees	50	3077	61.54	133	1
Cage excluding pollinators	100	49	.49		
Open field, 1927	150	13984	93.23	166	36
Open field, 1930	200	13452	67.36	122	4
Night exposed	100	99	.99	23	0
Day exposed	109	7371	67.62	119	0
Alfalfa not a competitor	102	6411	62.84	122	4
Alfalfa in bloom	98	7041	71.84	115	19

To indicate the type of seed counted, samples were submitted to the Colorado Seed Laboratory and found to be 100 percent viable. These seed counts were made from first-crop clover and bear out the opinion of Hopkins (10) that red clover can and will set a good crop of seed. The

writer has been unable to find research data to prove that the first crop does not produce seed.

Ratio of Flowers to Seed Set.—In determining the percentage of flowers setting seed, 50 heads in bloom were taken from each of three fields. Also 50 ripe heads were taken from the same three fields at the same time and the seed counted. No double or damaged heads were considered. While this method was inaccurate to some extent, no method suitable to this investigation was found by which flowers and seed could be accurately counted on the same head. The following table indicates the relationship of the number of flowers per head to the seed set per head, in three fields.

TABLE 5—COMPARISON OF SEED SET TO FLOWERS PER HEAD.

Field.	Heads.	Number of flowers.	Seed set.	Percentage setting seed.
1	50	100.46±1.87	88.96±2.2	88.55
2	50	114.22±1.63	99.68±1.94	87.36
3	50	119.28±1.93	91.04±2.02	76.32

It was noted that Hopkins (10) counted the flowers on 23 average heads selected from different plants on the first crop and found them to have from 92 to 163 flowers, and an average of 112.7 flowers to the head.

The Flower at Pollinating Time.—In observing the condition of the flower at pollinating time, it was noted thruout these investigations that bees apparently prefer the flower in full flush bloom. Occasionally a bee would attend a flower before or after this time, but preference was given to those flowers as above mentioned. It was also observed that not all flowers on the same head come in full blossom at the same time. Most heads progress to pollinating condition, a few flowers at a time. The only time when all flowers on the same head were in bloom at once, was when cages covered the plants and excluded pollinating insects.

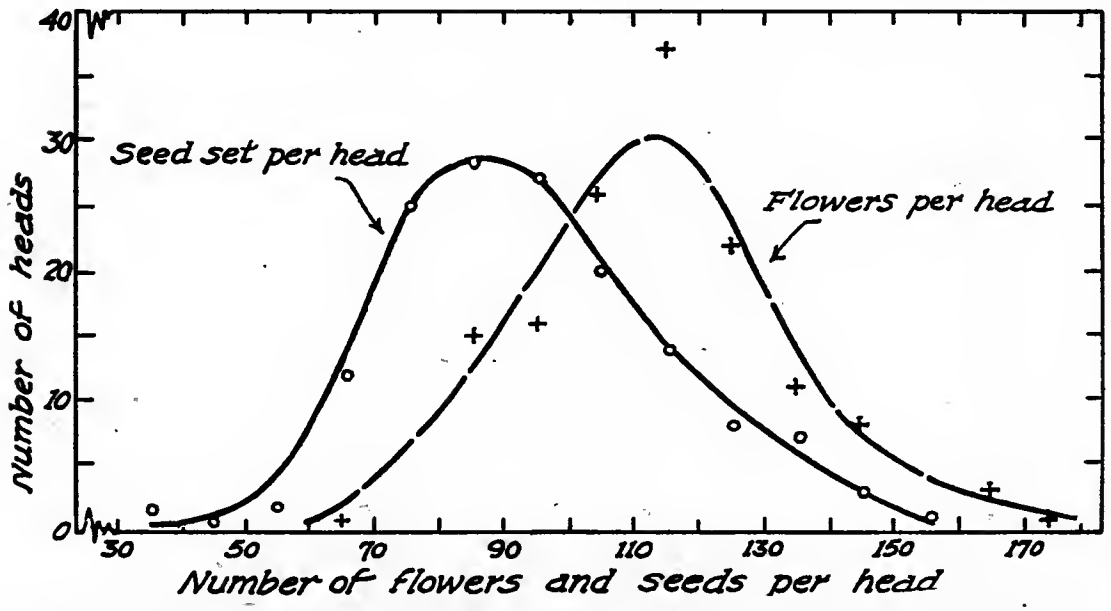

Figure 5—Frequency curve showing comparison of distribution of flowers per head (+) and seed set per head (°), in 150 heads from three fields in 1927.

This gave the head, at full bloom, the appearance of being much larger and more robust. Neither are all heads on the same plant in bloom at the same time. This sequence of flowering enhances the problem of selecting the time for cutting to secure an optimum seed crop.

While noting the condition of the flower, the presence or absence of nectar was remarked upon. Flowers were plucked from hundreds of heads in many fields in Southern and Northern Colorado. Holding these flowers so that strong sunlight furnished good illumination, no nectar could be detected in the corolla tube. Efforts to squeeze nectar from the tube only resulted in a tiny moistness from broken plant tissues. An exceedingly delicate sweetness might be observed in sucking several tubes at once. Despite this apparent dearth, honeybees were observed inserting the proboscis down the tube, straining as tho to reach some nectar. The work of Parker (17) indicates that this is the method by which honeybees secure pollen from flowers of the type of red clover.

Corolla-tube measurements were made on 625 flowers from 125 heads, during two seasons. Some flowers were taken from the apex of the head, some from the side and some from the base, near the bracts.

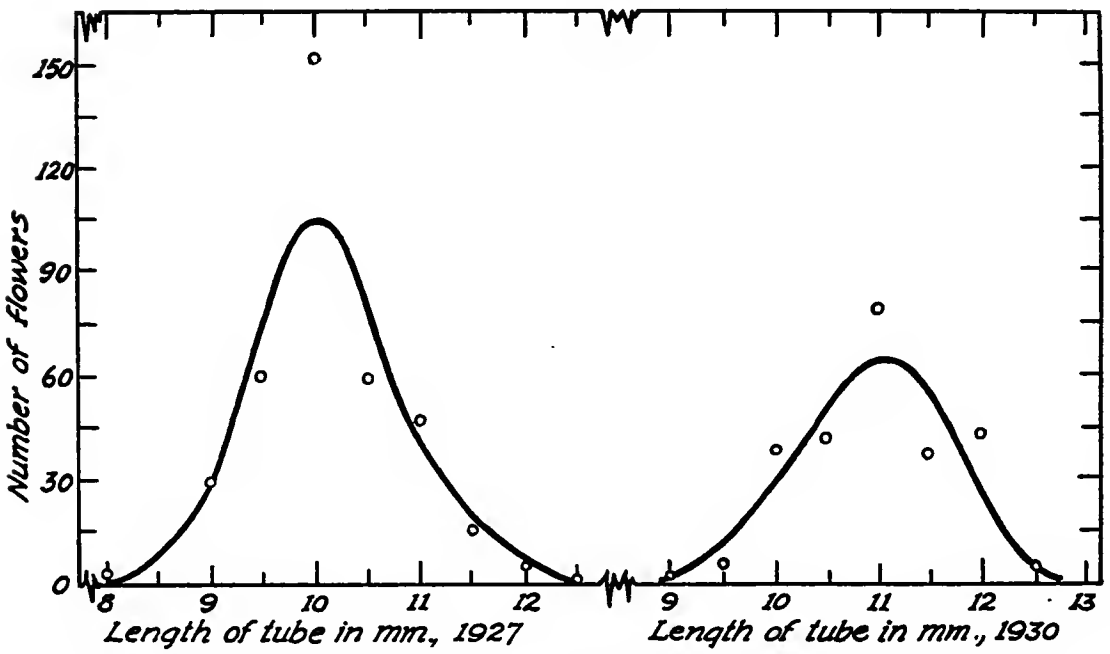

Figure 6.—Frequency curve of corolla-tube lengths in 374 flowers in 1927 and in 252 flowers in 1930.

TABLE 6—MEAN LENGTH OF COROLLA TUBES IN MILLIMETERS, IN FIVE FIELDS AND TWO SEASONS.

Season.	Field number.	Number of flowers.	Mean length.
1927	1	125	10.6 ±.04
1927	2	125	10.63±.023
1927	3	124	9.79±.033
1930	4	125	10.91±.056
1930	5	127	11.1 ±.039
1927	1, 2 and 3	374	10.13±.024
1930	4 and 5	252	10.97±.031
1927 and 1930	1 to 5	626	10.47±.022

Selection depended on the position of the florets which were in prime pollinating condition. These measurements were made in the field without a microscope and extended from the base of the tube to the juncture of the vexillum and carina. Table 6 and Figures 6 and 7 show the results of this study.

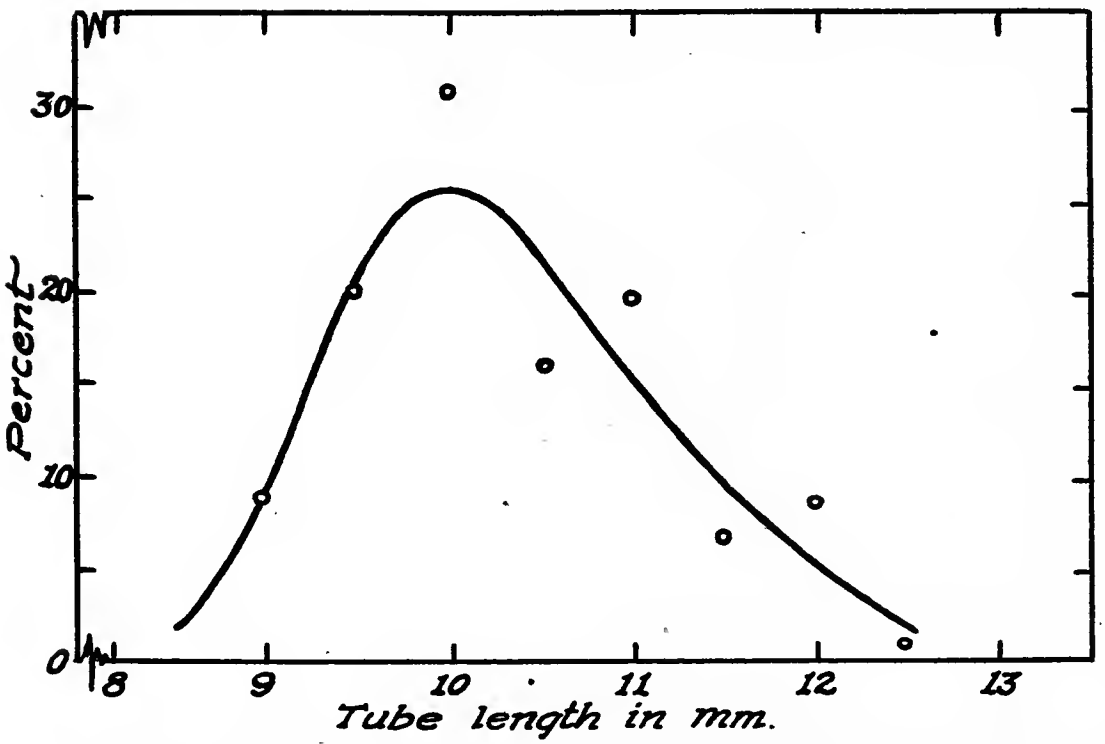

Figure 7.—Frequency curve showing percentage of corolla tubes occurring in certain lengths. Curve is based on data from 626 flowers, in five fields, during two seasons.

Summary.

1. Honeybees were found to be carrying red-clover pollen. A large percentage of the bees observed, were active pollinators of red clover. These insects are a major factor in pollination of this plant in Colorado, east of the mountains. Red clover seems to be a convenient and prolific source of pollen for honeybees in some Colorado localities.

2. Honeybees will carry nectar and pollen on the same fielding trip and both in considerable quantities.

3. Insects, capable of penetrating a 13-mesh screen wire, are a minor factor, if an agent at all, in the pollination of red clover at Fort Collins and Rocky Ford.

4. Night-flying insects are not instrumental in red-clover pollination at Fort Collins.

5. The length of the corolla tube apparently has no bearing on red-clover pollination by honeybees.

6. Alfalfa in bloom, does not withdraw the attention of honeybee pollinators from red clover.

7. First-cutting red clover sets a good crop of seed when conditions are such as to be inviting to honeybees.

8. There is a sequence of bloom among the flowers on the head and among the heads on the plant.

9. Corollas of unpollinated flowers remain in flush bloom much longer than those which have been attended by pollinators.

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POLLINATION OF DECIDUOUS FRUITS BY BEES.*

(G. L. PHILP[1] and G. H. VANSELL[2].)

INTRODUCTION.

Most fruit growers are familiar with investigations and field studies in cross-pollination. Beekeepers, however, are generally as unacquainted with the details of fruit pollination as are the fruit growers with bee problems. This circular attempts to summarize the results of deciduous fruit pollination studies and to point out some bee habits and structures, with special reference to the collection and storage of pollen. Such a paper may perhaps serve as a practical handbook for reference, especially in the field, and facilitate satisfactory pollination arrangements between fruitmen and beekeepers.

The pollination data have been prepared by the first author from material contained in various California Agricultural Experiment Station publications, most of which are now out of print, and supplemental with unpublished data from the Division of Pomology. The second author has prepared the material on bee habits and structures.

POLLINATION SUMMARY OF DECIDUOUS FRUITS.

Among the causes responsible for nonbearing of deciduous fruits are lack of vigor in the tree, presence of injurious insects and diseases, unfavorable weather at blossoming time, winter injury, lack of pollination, and inability of the pollen to fertilize the ovule. This discussion will deal only with pollination as a cause of nonbearing, it being assumed that the orchard is planted in a favorable location and that the trees are kept in normal vigor and free from serious insect and disease troubles.

The following definitions may clarify the discussion:

Pollination[3]*:* the transfer of pollen to the stigma; or, in a large sense, the distribution of pollen. Pollination may be accomplished by insects, wind, gravity, water, artificial methods (in experimental work), and birds.

Pollinizer: a plant (tree) used to furnish pollen. The male parent.

Fertilization: the union of the male germ cell, contained in the pollen grain, with the female germ cell or egg in the ovary.

Fruitful: the term applied to a plant that sets and matures fruit.

Unfruitful or barren: terms describing a plant or variety that is unable to set fruit and mature it.

Fertility: the ability not only to set and mature fruit but to develop viable seed.

Sterility: the inability to set and mature fruit with viable seed.

Self-fruitful: the term applied to a plant that sets and matures fruit with its own pollen.

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* Reprint from California Agricultural Extension Service, Circular 62, April, 1932.

[1] Associate in Pomology.

[2] Associate in Entomology; resigned.

[3] Pollination experiments and investigations include not only the study of the transfer of pollen but also studies of fruit setting associated with pollen transfer and fertilization. In any mention of pollination studies and problems, this broader definition will be intended.

Self-unfruitful or self-barren: terms describing a plant that is unable to set fruit and mature it with its own pollen.

Inter-fruitful: the term applied to a variety capable of setting and maturing fruit when pollinized with a different variety.

Inter-unfruitful or inter-barren: terms describing a variety not capable of setting and maturing fruit when pollinized with a different variety.

The reasons for nonbearing, from a pollination standpoint, are not all known. Some of them, aside from weather conditions, are incompatibility, imperfection or degeneration of sex organs, slow growth of the pollen tube, and premature or delayed pollination.

The fruit grower has a pollination problem with almonds, cherries, plums and prunes, apples, pears, and berries. In general, apricots, peaches, and walnuts set well with their own pollen and hence present no difficulties from this standpoint. The J. H. Hale peach, however, is self-unfruitful and must be interplanted with some other variety. Recent studies indicate that some varieties of walnuts in certain years do not mature the staminate and pistillate flowers at the same time and therefore, under these conditions, cannot pollinate themselves.

With the fruits having a pollination problem, the grower must consider the following factors in selecting the pollinizers: coincidence of bloom, amount of pollen produced, germinability of pollen, commercial value of pollinizer, succession in ripening, and regularity of production of the pollinizers used. Varieties which do not blossom at the same time will not cross-pollinate each other.

Most fruits with showy flowers (fig. 1) require insects to carry the pollen from flower to flower. Bees are the most important insects for this work. The grower should therefore have plenty of bees in the orchard during the blossoming period.

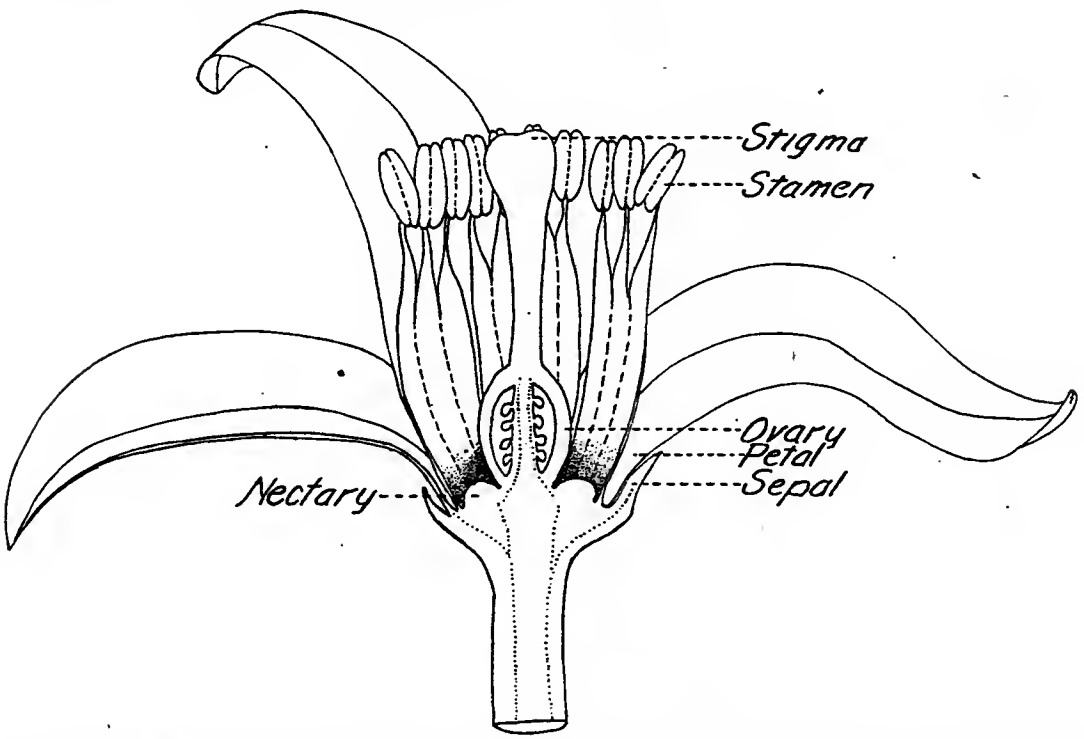

Figure 1—Diagram of orange flower in longitudinal section showing location of typical floral parts. The orange blossom has been used rather than the flower of a deciduous fruit because it shows the nectary more conspicuously.

The California Agricultural Experiment Station has conducted pollination experiments with certain fruits. The results may be summarized as follows:

Almonds.

The following varieties of almonds are self-unfruitful under California conditions and hence should not be planted in blocks of one variety:

Big White Flat	Golden State	King	Nonpareil
California	Harriott	Klondike	Peerless
Drake	I. X. L.	Lewelling	Reams
Eureka	Jordan	Ne Plus Ultra	Texas.

Some varieties of almonds are inter-unfruitful—for example, the following:

Nonpareil with I. X. L.
Languedoc with Texas

Almonds may be classed as early or late in time of blossoming, as given below. Nonpareil has been given in both lists since it occupies a position about midway.

Early			*Late*
Big White Flat	Lewelling	Dickinson	Nonpareil
California	Ne Plus Ultra	Drake	Reams
Harriott	Nonpareil	Eureka	Sellers
I. X. L.	Peerless	Golden State	Texas
Jordan	Princess	Languedoc	
King	Silver Shell		
Klondike			

The accompanying chart, figure 2, gives the average blossoming dates of certain almond varieties. The date of bloom is dependent upon many factors, such as soil, season, and location.

With the exception of the above-noted cases of inter-unfruitfulness, any variety in either of the above lists may be used in most instances as a satisfactory pollinizer for any other variety in the same list. Table 1, compiled from the experiments of Tufts and Philp,[4] summarizes the pollination requirements for almonds. Variety names at the left of the chart indicate the tree, and the names across the top indicate the pollen used. For example, if pollen from the variety Drake were used on a tree of the variety California a good set would result, as indicated by the symbol *G* in the table.

[4] Tufts, W. P., and G. L. Philp. Almond pollination. California Agr. Exp. Sta. Bul. 346:1–35. 1922.

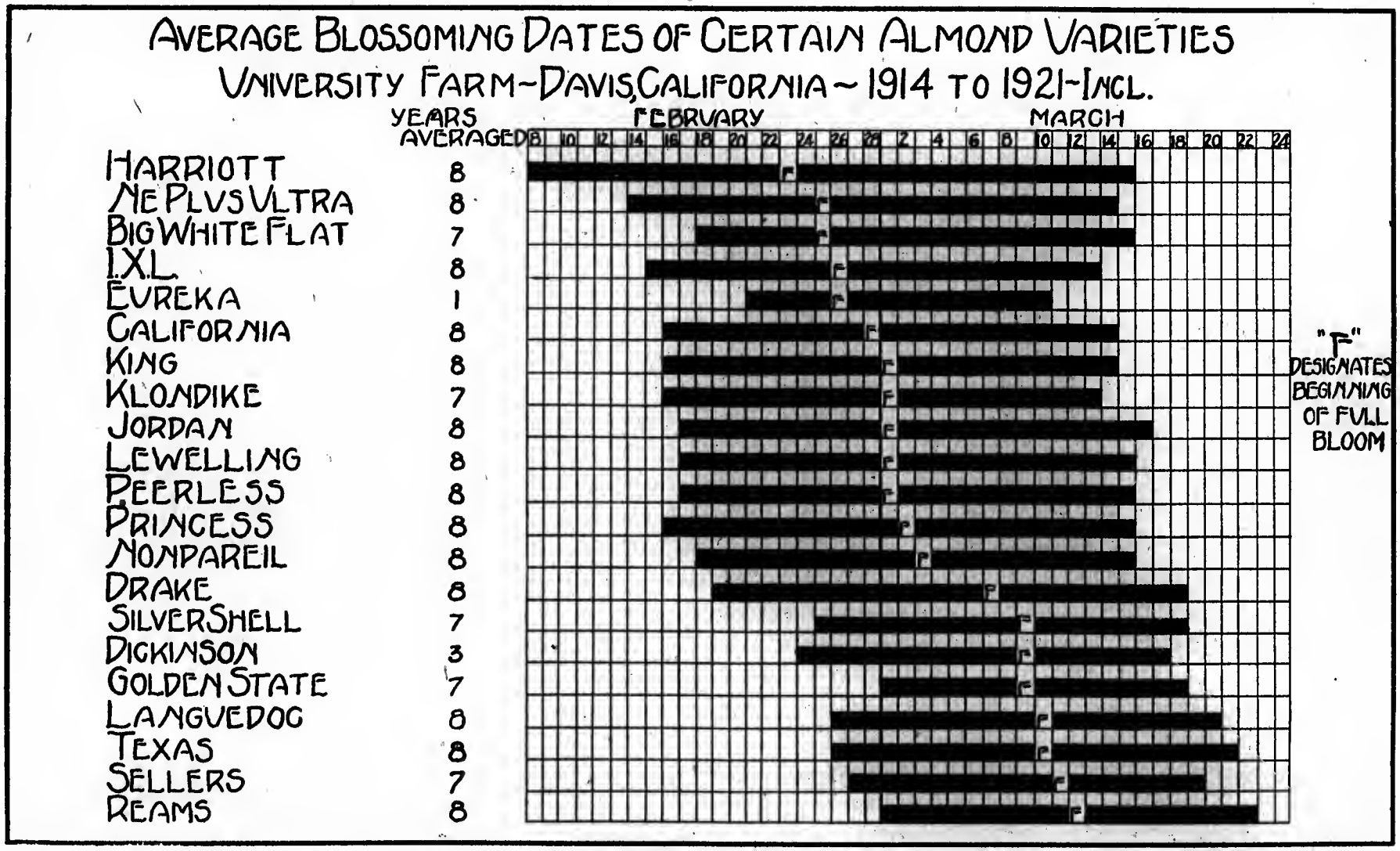

Figure 2—The average dates of the first, last, and full bloom of certain almond varieties covering a period, in nearly all instances, of eight years. The number of years averaged is shown in a separate column for each variety. (From Bul. 346.)

Apples.

Although this is not a complete list, apple varieties may be segregated according to their pollination requirements as follows:

Self-fruitful	*Self-unfruitful*	*Doubtful*
Baldwin	Arkansas	Ben Davis
Early Harvest	Arkansas Black	Esopus Spitzenburg
Grimes Golden	Delicious	Gano
Oldenburg	Fameuse	Jonathan
Wagener	Gravenstein	Rome Beauty
Wealthy	McIntosh	Tompkins King
Yellow Newtown	Northern Spy	York Imperial
Yellow Transparent	Rhode Island Greening	
	Stark	
	Stayman	
	Twenty Ounce	
	White Pearmain	
	Winesap	
	Winter Banana	
	Yellow Bellflower	

The varieties in the self-fruitful list will generally produce larger crops when cross-pollinated. Under most conditions, however, commercial crops will result when they are planted in solid blocks (self-pollinated).

The varieties in the unfruitful list are unsafe to plant alone and should be interplanted with some other variety for cross-pollination.

The varieties in the doubtful list will in some years, under certain conditions, produce commercial crops. The evidence indicates, however, that better commercial crops will result if provisions for cross-pollination are made.

Few cases of inter-unfruitfulness appear among apple varieties. Winesap, Arkansas, Arkansas Black, and Stayman seem to be inter-unfruitful and should therefore not be planted together. The Arkansas, Stayman, and Gravenstein are generally unsatisfactory pollen producers, a fact which makes them undesirable pollinizers for other varietis. Except for the cases indicated above, varieties which blossom together will cross-pollinate each other. The Delicious and Yellow Newtown seem to be the best varieties to cross-pollinate the Gravenstein.

Cherries.

All commercial varieties of sweet cherries are self-unfruitful. Tests show that the following are self-unfruitful under California conditions:

Abundance	Burbank	Mezel
Advance	Chapman	Napoleon (Royal Ann)
Bing	Centennial	Pontiac
Black Heart	Cleveland	Rockport
Black Republican	Early Purple	Windsor
Black Bigarreau	Lambert	Wood
Black Tartarian	Major Francis	

Some varieties of sweet cherry are inter-barren—for example, the following, under certain conditions:

Bing, Lambert and Napoleon with each other
Rockport with Advance
Early Purple with Rockport

TABLE 1.
CHART SHOWING POLLINATION COMPATIBILITIES OF ALMOND VARIETIES.*

Variety.	Source of pollen.																			
	Big White Flat	California.	Drake.	Eureka.	Golden State.	Harriott.	I. X. L.	Jordan.	King.	Klondike.	Languedoc.	Lewelling.	Ne Plus Ultra.	Nonpareil.	Peerless.	Princess.	Reams.	Sellers.	Silver Shell.	Texas.
Big White Flat	O					F							P							
California		O	G				G	F					F	G		F				
Drake		G	G	G			G	G			G		G	G	G					G
Eureka			G	O										G						
Golden State			G		O															
Harriott	G					O	G						G							
I. X. L.		G	F			F	G	G				F	G	O	G					
Jordan		P					P	O					F	F						
King									O				G	G						
Klondike										O			G							
Languedoc		G	G	G			F				O		F	F	F		F			O
Lewelling		F					G					O	G	G						
Ne Plus Ultra		F	F			G	G	G	G			F	G	G	F					
Nonpareil		G	G	G	G		O	G			G	G	G	O	G					G
Peerless		F	G	F			P	F			G		G	F	O					G
Princess													G	G		O				
Reams		G	G				G				G		G	G			O			G
Sellers			F															O		
Silver Shell			G																O	
Texas		G	G	G			G				O		G	G	F		G			O

G—Good; F—Fair; P—Poor; O—No affinity.
* Data from Bul. 346.

There are, apparently, different strains of certain cherry varieties or else different varieties so similar as to be indistinguishable. This condition exists particularly with Black Tartarian, of which there are at least five strains which vary greatly in their ability to pollinize, especially the Napoleon. More than one strain of Black Republican, from a pollination standpoint, exists.

No entirely satisfactory pollinizer has as yet been determined for Napoleon. In most cases, however, certain strains of Black Tartarian and Black Republican yield satisfactory results. Findings in Oregon show that the long-stemmed Waterhouse variety is a fairly good pollinizer for Napoleon.

Cherry varieties may be classed as early or late blossoming, as follows:

Early		*Late*	
Advance	Burbank	Bing	Pontiac
Black Heart	Chapman	Lambert	Rockport
Black Republican	Early Purple	Napoleon	
Black Tartarian			

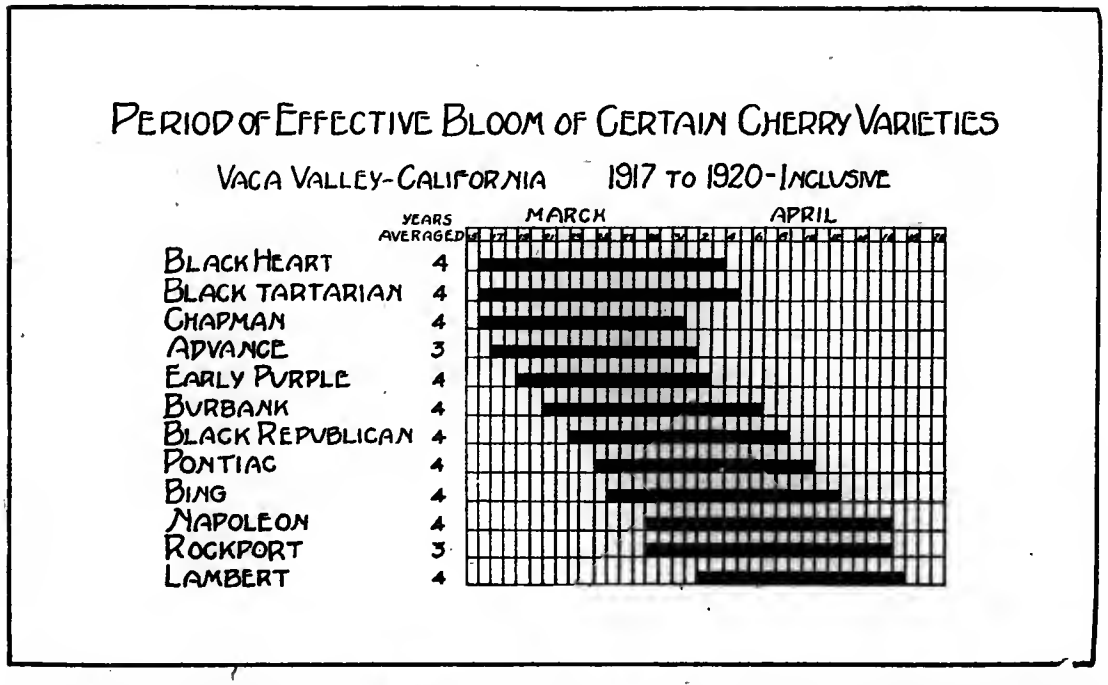

Figure 3—The period of effective bloom of certain cherry varieties, covering a period in nearly all cases of four years. The number of years averaged is shown in a separate column for each variety. (From Bul. 385.)

Black Tartarian and Black Republican generally overlap enough to pollinize most varieties in the second column.

The accompanying chart, figure 3, gives the average period of effective bloom for certain cherry varieties. The term *effective bloom* indicates the length of time the tree is in conspicuous blossom.

Table 2, compiled from the experiments of Tufts and Philp,[5] summarizes the results of cherry pollination. In some cases different results may be secured but in general this information will apply.

[5] Tufts, W. P., and G. L. Philp. Pollination of the sweet cherry. California Agr. Exp. Sta. Bul. 385:1–28. 1925.

TABLE 2—CHART SHOWING POLLINATION COMPATIBILITIES OF SWEET CHERRIES.*

Variety.	Source of pollen.																
	Abundance.	Advance.	Bing.	Black Heart.	Black Republican.	Black Tartarian.	Burbank.	Chapman.	Early Purple.	Early Rivers.	Knight.	Lambert.	Napoleon.	Pontiac.	Rockport.	Schmidt.	Windsor.
Abundance	O												F				O
Advance		O		G		G	P	G	G						O		
Bing			O		G	G			G			O	O	G	F		
Black Heart		G		O		G	G	G	G								
Black Republican			G		O	G			G			G	G		G		
Black Tartarian		F	F	F		O	F	G	F						F		
Burbank		F		G	G	G	O	G	F						F		
Chapman		G		G	F	G	G	O	P						F		
Early Purple		P		P	P	F	P	P	O						O		
Early Rivers										O			G				
Knight			G			G					O						
Lambert			O	G	G							O	O	G	F	O	
Napoleon	G		O		G	G				F		O	O	G	P	F	F
Pontiac		G	F		G	P						G	G	O			
Rockport		O		F	G	P	G	P	F			F	P	F	O		
Schmidt			O		O	P						O	O			O	
Windsor	O												G				

G—Good; F—Fair; P—Poor; O—No affinity.

* Data from Bul. 386, with supplementary data prepared by G. L. Philp.

PEARS.

Twenty-six varieties of pears have been tested by the Pomology Division under various California conditions.

Only the Hardy variety has proved to be self-fruitful under all conditions and during all seasons. Fifteen of these twenty-six varieties tend, under certain conditions, toward self-fruitfulness.

Bartlett pears are, to a certain extent, self-fruitful under valley conditions, and, in most instances, self-barren under foothill conditions.

Winter Nelis showed a tendency toward self-unfruitfulness under all conditions tested.

No cases of inter-barrenness have been found to exist between pear varieties.

A summary of the pollination results secured by Tufts and Philp[6] segregates pear varieties into three groups, as shown in table 3.

Those varieties in the doubtful list, although setting satisfactory crops under certain conditions, should for best crops be interplanted with some other variety.

[6] Tufts, W. P., and G. L. Philp. Pear pollination. California Agr. Exp. Sta. Bul. 373:1–36. 1923.

TABLE 3—SUMMARY OF POLLINATION RESULTS WITH PEARS.

Self-barren.		Self-fruitful.		Doubtful.		
Variety.	Years tested.	Variety.	Years tested.	Variety.	Number years self-fruitful.	Number years self-barren.
Alencon	2	Comice	4	Angouleme	1	1
Bloodgood	2	Flemish Beauty	1	Anjou	2	1
B. S. Fox	1	Hardy	3	Bartlett	5	2
Comet	1	Howell	3	Bosc	1	1
Forelle	2			Clapp Favorite	1	1
Le Conte	3			Clairgeau	2	2
Madeline	1			Col. Wilder	2	2
Winter Nelis	3			Dana Hovey	1	2
				Easter	1	2
				Gifford	1	1
				Glou Morceau	1	1
				Kieffer	1	4
				P. Barry	1	2
				Seckel	3	1

Pears have, in most cases, a comparatively short period of bloom. The varieties tested may be divided roughly as early and late blossoming, as follows:

Early		*Late*	
Alencon	Angouleme	Anjou	Bartlett
Bartlett	Clairgeau	Bloodgood	Bosc
Clapp Favorite	Easter	B. S. Fox	Comice
Dana Hovey	Howell	Comet	Glou Morceau
Forelle	Le Conte	Gifford	Winter Bartlett
Kieffer	P. Barry	Hardy	Winter Nelis
		Seckel	Col. Wilder

The following varieties, tested under California conditions, have proved to be successful pollinizers for the Bartlett:

Angouleme	Comice
Anjou	Dana Hovey
Bosc	Easter
Clairgeau	Forelle
Howell	Winter Nelis
Hardy	

Plums and Prunes.

Nearly all Japanese plums are self-unfruitful. Methley, Climax, Beauty, and Santa Rosa are partially self-fruitful. Like the rest, however, these four varieties set much better when interplanted for cross-pollination purposes. The self-barren list of Japanese plums follows:

Abundance	Duarte	Prize
Amador	El Dorado	Satsuma
Apex	Formosa	Sultan
Becky Smith	Gaviota	Upright
Burbank	Kelsey	Wickson
Combination	Los Gatos	

The early Japanese varieties, being usually deficient pollen producers, are unreliable for cross-pollination. The late blossoming varieties are satisfactory pollen producers and may be interplanted safely.

TABLE 4.
CHART SHOWING POLLINATION COMPATIBILITIES OF JAPANESE PLUMS.*

Variety.	Source of pollen.																					
	Self.	Abundance.	Amador.	Apex.	Beauty.	Becky Smith.	Burbank.	Climax.	Combination.	Duarte.	El Dorado.	Flickinger.	Formosa.	Gaviota.	Kelsey.	Los Gatos.	Methley.	Prize.	Santa Rosa.	Satsuma.	Upright.	Wickson.
Abundance	O	O					F	G														G
Amador	O		O			G		G							P							
Apex	O			O							P		P	P	P				P			
Beauty†	F			P	F		G			F	P		F	F	P				F			F
Becky Smith	O		O			O	F	F							O							
Burbank	O			P	G		F	G		G	P		P	P	P	G				G		G
Climax	G			P	G		G	G		G	P		P	P	P				F			F
Combination	O								O						O					P		P
Duarte	O			P	G		G			O	P		P	G	P				G			G
El Dorado	O										O								G			G
Flickinger	O											O										
Formosa	O			P	F		G			G	P		O	O	P				G			G
Gaviota	O			P	G		F			G	P		O	O	P				F			F
Kelsey	O			P	F			O			P		P	P	P				F			O
Los Gatos	O						G	G								O						G
Methley	F			G	G		G										F					
Prize	O																	O				
Santa Rosa	F			P	G		P			P	P		P	P	P				F			G
Satsuma	O			P							P		P	P	P					P		
Upright	O												P	G					P		O	P
Wickson	O			P	F		F	P			P		G	F	P				G	G		O

G—Good; F—Fair; P—Poor; O—No affinity.
* Data from Extension Circular 34.
† Tragedy, an early blooming Eureopean variety, will also effectively pollinate Beauty, Formosa, Gaviota, Methley, and perhaps other Japanese varieties.

The Japanese varieties may be divided as early or late blossoming, as follows:

Early		*Late*	
Beauty	Kelsey	Abundance	El Dorado
Combination	Satsuma	Amador	Los Gatos
Formosa	Santa Rosa	Apex	Methley
Gaviota	Wickson	Burbank	Prize
		Climax	Sultan
		Duarte	Upright

Formosa and Gaviota are apparently inter-barren, or at least unsafe for planting together. Tragedy is able to pollinate several Japanese varieties but it not pollinated by them. Table 4, by Allen,[7] summarizes the pollination requirements of Japanese plums.

European plums (including prunes) may be classed as self-barren, self-fruitful or doubtful, as follows:

Self-barren	*Self-fruitful*	*Doubtful*
Anita	California Blue	Conquest
Burton	Coates 1418 (Double X)	Grand Duke
Clyman	French	Pond (Hungarian)
Diamond	Giant	Stuart
Fellenberg (Italian)	Sugar	
Imperial	Yellow Egg	
Jefferson		
President		
Robe de Sergeant		
Quackenboss		
Silver		
Standard		
Sultan		
Tragedy		
Washington		

The doubtful list includes varieties which in some years may produce satisfactory crops with their own pollen but which one should probably not plant without providing for cross-pollination.

There is apparently no inter-unfruitfulness among European plums. In some years, however, certain varieties do not set satisfactory crops. In general, varieties blossoming at the same time will cross-pollinate effectively. Although this is not a complete list, the following varieties may be grouped together according to the time of blossoming:

Early	*Mid-season*	*Late*
Clyman	Burton	California Blue
Tragedy	Coates 1418 (Double X)	Fellenberg (Italian)
	Diamond	Giant
	French	President
	Grand Duke	Pond (Hungarian)
	Imperial	Quackenboss
	Jefferson	Silver
	Robe de Sergeant	Washington
	Sugar	Yellow Egg
	Standard	
	Stuart	

Table 5, by Allen,[8] summarizes the pollination requirements of European plums.

[7] Allen, F. W. Plum growing in California. California Ext. Cir. 34:1–65 1929.

[8] Allen, F. W. Plum growing in California. California Ext. Cir. 34:1–65. 1929.

TABLE 5—CHART SHOWING POLLINATION COMPATIBILITIES OF EUROPEAN PLUMS.*

Variety.	Source of pollen.																													
	Self.	Anita.	Burton.	California Blue.	Clyman.	Coates 1418.	Conquest.	Diamond.	Fellenberg (Italian).	French	Giant.	Grand Duke.	Hungarian.	Imperial.	Jefferson.	Pond.	President.	Quackenboss.	Robe de Sergeant.	Silver.	Splendor.	Standard.	Stuart.	Sugar.	Sultan.	Tragedy.	Washington.	Yellow Egg.
Anita	P	P								G												F	F	G				
Burton	P		P							G											G		O	G				
California Blue	G			G				G			O	F		O			G											
Clyman	O				O			G				G	G			G										G		
Coates 1418	F					F				F				G										G				
Conquest	P						P			G														G				
Diamond	F			G				F				G					G									G		
Fellenberg (Italian)	P								P											G								
French	F									F				G					F					G				
Giant	G										G																	
Grand Duke	P			G	F			G			F	P					G									G		
Imperial	O									F				O										F				
Jefferson	P													G	P									G				
Pond (Hungarian)	F			G							G	F		F		F												G
President	O		G	G	F			G		G	G	G	F	G		F	O	F			G			G		F		F
Quackenboss	P			G				G				G					G	P										
Robe de Sergeant	P									G			G			G			P					G		G		
Silver	P								G											P								
Splendor	O	G								G											O	G	G	G				
Standard	O	G						G		G											G	O	G	G				
Stuart	F					G								O									F					
Sugar	G									G				G					F					G				
Sultan	O																								O			
Tragedy	O				G			G				F				P			G					P		Q		F
Washington	O																										O	
Yellow Egg	G																											G

G—Good; F—Fair; P—Poor; O—No affinity.

* Data from Extension Circular 34 with supplementary data by A. H. Hendrickson, Associate Pomologist.

Arrangement of Pollinizers.

In planting an orchard where pollinizers are required, one should, if possible, have every sixth and preferably every fourth row a pollinizing variety. For convenience in harvesting it is best to plant two, four, or six rows of one kind, then two of the pollinizing variety, and repeat. In some instances it is desirable to have a minimum number of pollinizers. Under these circumstances, one tree to eight, planted as every third tree in every third row, is recommended. This arrangement places a pollinizer next to every tree of the main variety in the orchard.

Certain conditions may make it advisable to graft a pollinizer into every tree to insure satisfactory cross-pollination. Such an arrangement will, of course, tend toward confusion in harvesting; when the pollination problem is serious, however, the grower can afford to forget the commercial value of the fruit on the pollinizing branch.

The suggestion given above is primarily for the orchardist whose mature trees, because of the planting of self or inter-barren varieties, have failed to fruit. During the years when one is waiting for the trees grafted over to pollinizing varieties to come into bearing, some relief may be obtained by cutting off branches of pollinizing varieties, placing the cut ends into vessels of water, and distributing them throughout the orchard during the blossom period. Such branches will live for several days and continue to bloom, forming pollen for the bees to transfer to the unfruitful variety.

The Honeybee as a Pollen Distributor.

The intimate relationship between bee life and plants is well known to students of nature. Certain bees require pollen and nectar for sustaining life; the pollen, in the case of the hive bee, is fed, along with other substances, to the larval forms; while nectar is converted to honey primarily for adult food. In many cases, the plants require the pollen from other varieties of the species for the setting of fruit and seed. Nectar, a weak sugar solution, attracts many insects; and its presence in close proximity to the stamens better assures visitation by the living pollen carriers. The bee wholly depends for existence upon the plant products——pollen and nectar; while, on the other hand, many plants would fail in productivity except for the presence of insects suitable for effecting cross-pollination.

Pollen Manipulation by the Bee.

The structures over the body of the worker bee are admirably designed for the efficient collection and transportation of pollen. In the first place, the whole body is densely clothed with hairs (fig. 4), which are barbed in such a way that pollen grains of varying size (figs. 5 and 6) cling to them. The legs, too, bear pollen-manipulating devices: each front leg, for example, has a notch of the proper diameter for

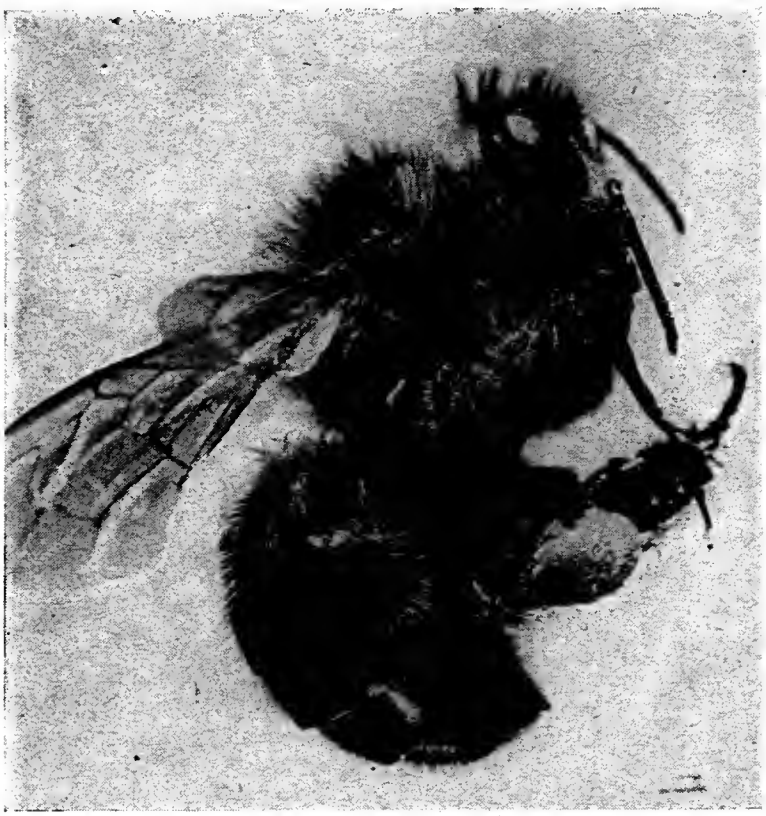

Figure 4—The body of the hive bee is completely covered with hair, in which the pollen grains become entangled. The bee, before it starts its return flight to the hive, combs the grains into the pollen basket. See figure 7.

stripping the antennae clean; the middle and hind legs have spines, spoon-shaped depressions (called pollen baskets), hair combers, etc.

The bee partiallly cleans its body of pollen grains by means of the combs and other structures. A large ball of pollen is finally formed in the pollen basket, on the outside of each rear tibia (fig. 7), from which it is removed after being carried to the hive. Many pollen grains remain scattered over the bee's body, even after combing, and it is believed that it is this pollen which effects cross-pollination. The labor and time expended in collecting a load of pollen are considerable: often a bee spends an hour in working over the anthers of the blossoms (fig. 1) before returning to the hive. The different kinds of pollen (fig. 8) are stored in the cells of the comb until needed for feeding the bee larvae. Pollens from different plant species are of various color (white, yellow, brown, blue, red, etc.), a fact which facilitates their identification in the comb cells.

Figure 5—Photograph of femur from a bee's leg, showing hairs with pollen grains from some plant. This field bee was caught entering the hive, as it returned from a collecting trip. These grains come in contact with the viscid surface of the stigma as the bee pushes into the blossom for nectar or pollen, and bring about cross-pollination. Also see figure 6.

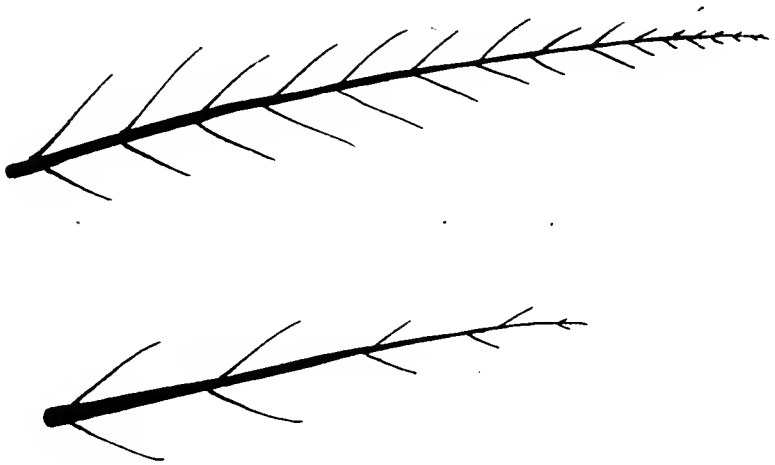

Figure 6—Diagrammatic sketches showing arrangement of barbs on the hairs of bees. The pollen grains cling on the hair between these barbs. The irregular spacing of barbs on the hair shaft is an adaptation suited to picking up pollen grains of varying size and shape. See also figures 5 and 8.

Figure 7—Hind legs of hive bee with large mass of pollen in the pollen basket upon the outside of the tibia. Note the combs on the first tarsal segment. The parts of the leg are the coxa (a), the trochanter (b), the femur (c), the tibia (d), and the five tarsal segments (e).

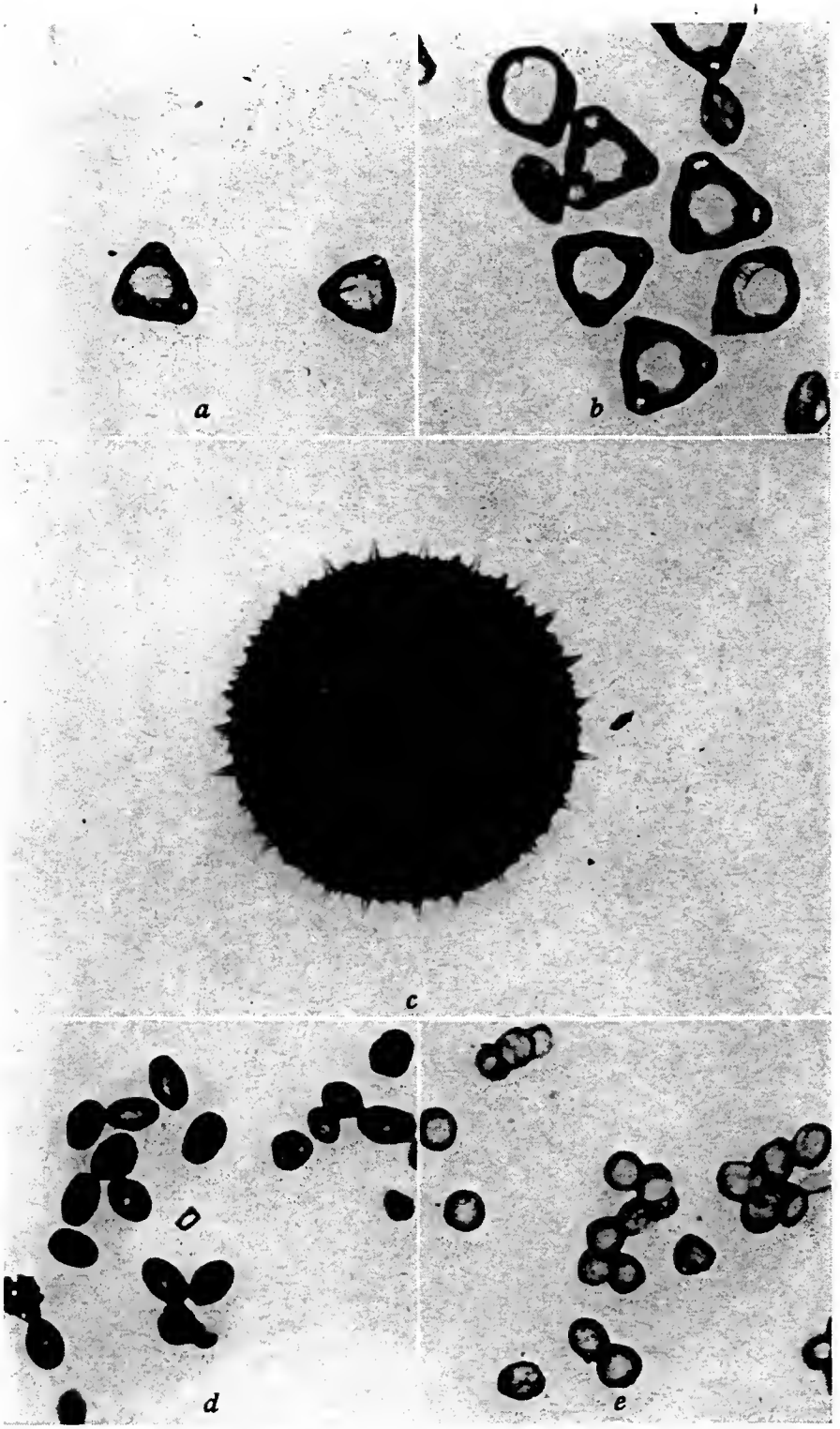

Figure 8—Photographs of pollen grains, indicating comparative size and shape: (a) cherry, (b) almond, (c) hollyhock, (d) olive, and (e) date palm. Magnification of all, × 250. Also see figures 5 and 6.

Some Collecting Habits of Bees of Value in Fruit Pollination.

Bees, whether collecting pollen or nectar, usually visit on a particular trip but one species of plant. Where blossoms are scarce, the bee may be forced to collect from more than one species; but such is not the case during fruit blossoming. Some species of plants are definitely preferred to others. The time of day influences availability of both nectar and pollen, so that activity shifts from one plant to another; for example, filaree, in the orchards, is very attractive during the early morning; but most of the blossoms close by 10:00 o'clock on sunny days. Apparently some of the fruits secrete nectar most freely during the night; bees quickly harvest this in the morning and then shift to some other plant. During certain seasons, for example, this change from prunes to mustard is particularly noticeable. Very often pear blossoms are less attractive than others which are open at the same time. Bees like apple blossoms particularly: they will sometimes leave pear for cherry and cherry for apple. In certain areas, at least, bees visit pear blossoms for pollen only; ignoring the nectar which is plainly visible. Some recent work indicates a variation in sugar concentration for various nectars, which may explain the periodic preference shown by bees for certain flowers.

Spraying Detrimental to Bees.

The problem of spray poisoning is often acute for bees near orchards where arsenic or nicotine is used on the plants. Not only are the nectar and pollen of trees contaminated, but those of the covercrop as well. In addition, bees drink up dew from leaves and thus may secure a fatal dosage of poison, so that one cannot entirely eliminate this source of loss even by properly timed spraying. Wherever covercrops occur in orchards, the spray poison problem is particularly serious. Beekeepers and fruit growers must, in short, cooperate if loss of bees is to be reduced to a minimum; and the beekeeper should receive timely warning to move out before spraying operations begin.

Set of Fruit Not Dependent Upon Bees Alone.

The need for more insects to bring about cross-pollination in areas of fruit concentration is well recognized by scientific workers and many orchardists. One must emphasize the fact that a supply of pollinating insects alone is not sufficient to cause a commercial set of fruit, but that other factors, such as favorable weather and suitable varieties properly planted, are also important. The fact that hive bees are efficient pollen distributors which can be placed where and when wanted, needs only to be mentioned.

Beekeeping a Specialty.

The fruit-grower is usually too busy with orchard problems to become an efficient beekeeper. Bees require considerable attention *throughout the year* if they are to be strong in numbers at the end of winter.

Only strong colonies will prove of much value during early spring, when a large number of bees are required in the hive to maintain the brood nest temperature at 95° F. (fig. 9). Generally, the most feasible plan for securing pollinating insects is to rent bees from highly skilled beekeepers. The importance of an early agreement must be stressed, because many cases of bee shortage are annually reported too late for correction.

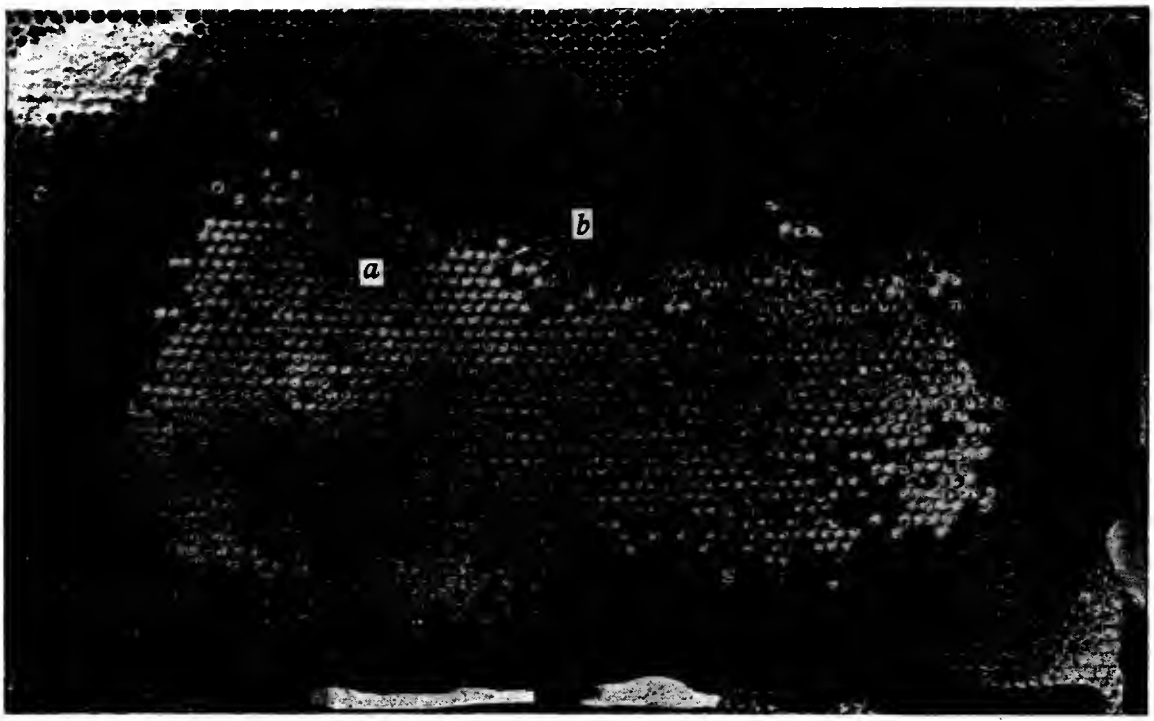

Figure 9—A bee comb illustrating the large area occupied by brood during fruit blossoming time; five to ten combs are necessary. Both sealed (a) and unsealed brood cells (b) as well as honey (upper left) may be seen. During periods of low temperature, as often occur during fruit blossoming time, all the bees in a weak colony may be needed in the hive to keep up the temperature for brood; therefore, it is only in the case of strong colonies that there are bees available for field work.

Number of Bees Required for Pollination.

The usual recommendations call for one colony of bees to the acre of fruit to be pollinated. The condition of the weather so affects results, however, that often more bees would justify their cost, while at other times even the prescribed number probably exceeds actual requirements. According to one beekeeper at Oroville, a section near him has 10,000 acres of prunes and 3,000 acres of pears with a bee population of only 1,000 colonies (1930). This number of bees must certainly be inadequate for best results, particularly when the general insect population, because of weather conditions or other cause, is low. Table 6 shows the acreage of fruits (exclusive of grapes) and the registered number of colonies of bees in the counties of California. The colony figures are primarily from the State Department of Agriculture registration list for 1929.

TABLE 6.

LIST OF CALIFORNIA COUNTIES WITH FRUIT ACREAGE AND NUMBER OF BEE COLONIES.

County.	Bearing fruit acreage.*	Colonies of bees.
Alameda	7,708	2,944
Alpine	1	2
Amador	970	48
Butte	21,864	8,449
Calaveras	507	224
Colusa	3,687	6,322
Contra Costa	12,417	3,321
Del Norte	4	71
Eldorado	5,374	662
Fresno	43,911	16,875
Glenn	8,497	5,931
Humboldt	1,665	1,531
Imperial	4,930	19,639
Inyo	1,102	3,640
Kern	8,470	11,142
Kings	13,191	5,911
Lake	7,141	120
Lassen	185	981
Los Angeles	71,567	38,389
Madera	9,079	2,010
Marin	633	443
Mariposa	263	67
Mendocino	5,295	1,068
Merced	20,485	8,188
Modoc	434	1,114
Mono	74	100
Monterey	8,823	4,546
Napa	14,528	1,217
Nevada	2,349	199
Orange	49,159	15,742
Placer	30,910	311
Plumas	34	47
Riverside	39,835	22,585
Sacramento	24,399	5,864
San Benito	15,532	404
San Bernardina	74,055	39,830
San Diego	12,379	30,279
San Francisco	.....	67
San Joaquin	21,308	13,573
San Luis Obispo	5,826	3,438
San Mateo	1,843	188
Santa Barbara	3,197	4,846
Santa Clara	102,617	3,275
Santa Cruz	18,775	538
Shasta	2,173	4,510
Sierra	19	118
Siskiyou	364	1,256
Solano	24,062	2,139
Sonoma	42,994	2,157
Stanislaus	31,343	8,200
Sutter	45,329	4,846
Tehama	8,228	4,728
Trinity	26	163
Tulare	76,377	11,446
Tuolumne	2,071	408
Ventura	11,900	14,873
Yolo	15,078	3,511
Yuba	9,663	1,031

* These figures do not include grapes.

PLACING THE BEES IN THE ORCHARD.

Bees are moved into orchards of this state almost entirely by motor truck or trailer. The actual move is usually made during the night. The entrances of the hives are as a rule closed, before moving, with some screening device or cloth material. During hot weather a moving-screen, in place of the hive cover, is essential for ventilation.

The recommendation of one hive to the acre does not mean that one hive should be located on each acre. Under normal conditions it is sel-

dom that bees are left in orchards in groups under ten colonies. The manipulation of single colonies is too difficult, particularly after rains; also the increased time and labor required for removal of scattered colonies adds to the expense. Sunshine, wind, temperature, rain, and other factors outside of the hive affect the flight of bees; therefore, general recommendations cannot be given relative to the proper placement of the colonies in the orchard. If the weather is fair and warm, during fruit-blossom time, bees can undoubtedly fly far enough to cover 100 acres or more of fruit from one location; on the other hand, during a cold wet season flight is very limited. The absence of fruit or nuts, except within a few rows distant from the bee location, is occasionally reported following a particularly bad spring.

Under average conditions bees in groups of 10 to 20 colonies, for as many acres surrounding them, have been found very satisfactory both to the fruit grower and the beekeeper. Accessible situations along roadways in the orchards should be chosen, because of mud as well as the difficulty of driving the trucks among the trees at night.

The bee population as is evident in the table is strikingly low, in comparison with the fruit acreage, for several of the important fruit counties in northern California, notably Eldorado, Napa, and Nevada. Some beemen regularly move bees into these fruit areas on a rental basis. A factor partly responsible for this low resident bee population is the presence of the detrimental California buckeye tree. The lack of a major honey plant also greatly reduces the possibility of profitable beekeeping. Undoubtedly the intensive insecticidal spraying operations practiced in many deciduous fruit areas play a part too in further reducing the number of bees.

To the southward, on the other hand, the number of colonies of bees increases greatly in proportion to the fruit acreage requiring pollination. In the upper end of the San Joaquin Valley, for example, at the present time, bees are rarely rented to the fruit grower for pollination purposes. Beemen are, in fact, very desirous of locating near deciduous fruit orchards to enable their colonies to build up early in preparation for the orange honey flow during April. Tulare County alone has some 33,000 acres of citrus fruits.

Cost of Renting Bees.

The rental price paid by the fruit grower for bees in orchards depends upon several factors: for example, necessary moving distance, condition of roads, local rainfall, and supply of bees, coupled with demand. In a given area, like the Santa Clara Valley, rental possibilities change with time: during the World War, for example, with the accompanying high price of prunes, many bees were moved in from the vicinity of Modesto at $5.00 to $7.00 per colony for the blossoming period. Now but few bees are taken in—mostly for cherry orchards, at $2.00 to $2.50 rental. The beekeepers, in fact, find it difficult to surmount the barriers set up by the sentiment of pear growers concerning blight. The present rental demand for bees in California comes largely from almond and plum growers, though the cherry, apple, and foothill pear growers also rent a good many colonies.

The earlier in the fall a fruit grower can place his order for bees, the greater the chance for satisfactory accommodation, because after the orchard becomes muddy, moving is difficult. Experience has taught beekeepers the unprofitableness of renting colonies at current prices when expensive moving problems arise. The average rental price at present is perhaps $2.00. The fruit growers should insist on good, strong colonies, for these are by far the most efficient in pollination.

THE INFLUENCE OF BEES UPON CLOVER AND ALFALFA SEED PRODUCTION.*

(C. R. MEGEE AND R. H. KELTY, Sections of Farm Crops and Horticulture.)

It is common observation that along with the decrease in the numbers of bumble bees and other wild bees there has been a decrease in the production of clover seed. It has generally been supposed that the honey bee is too small to be of assistance in pollinating clover and too light in weight to trip alfalfa blossoms. This experiment was planned to determine whether the pollinizing activity of honey bees and certain other insects influence the production or yield of alsike clover, June or medium red clover, and alfalfa seed.

Procedure—Areas were selected in Chippewa County in the Upper Peninsula and in Cheboygan County in the northern part of the Lower Peninsula where there were no honey bees in the locality except those brought in for the purpose of this experiment. In the areas selected in Chippewa county, alsike and June clover seed are produced commercially and in the area selected in Cheboygan County alfalfa seed is produced commercially.

A series of cages 36-in. x 36-in. were constructed and a portion of these cages covered with a very fine mesh nainsook to restrict the very small insects present at the blooming period and to exclude the larger insects and the bees. Another portion of the cages was covered with wire screen of 1/8-inch mesh to allow the smaller insects free access to the blossoms but to exclude the bees. The cages were placed on the alsike, June clover, and alfalfa plants previous to the opening of the blossoms and at varying distances from the honey bee colonies which had been moved into the fields.

To obtain a concentration of honey bee activity within a cage, a hive of honey bees was placed half way into one side of the cage. The bees were given an entrance, into the cage through the rear of the hive but they also used their regular entrance through the front of the hive. An opening about 6 inches square was made in the top of the cage to allow the bees to leave the cage readily in case they did not return to the hive. The second year of the project, 1931, one of these cages containing bees was placed over alsike clover, one over June clover, and one over alfalfa plants.

Observations—Small insects were very numerous among the uncaged clover and alfalfa plants in the field. By sweeping the plants with a collector's net it was found that the majority of the small insects were

* Reprint from Michigan Agricultural Experiment Station Quarterly Bulletin, Vol. XIV, No. 4.

leaf bugs, leaf hoppers, plant lice, and flies. Several kinds of small wild bees were present in moderate numbers and were actively visiting the blooms in the open field when weather conditions were favorable. However, cool winds and cloudiness greatly reduced their activity.

Bumble bees were not plentiful. During one two-hour period of observation, although weather conditions were favorable for insect activity and small wild bees were very numerous and active, but three bumble bees were observed in a twenty-acre field of June clover. When air temperatures ranged from 75° to 90° F., all of the insects under observation were active in the field during the blooming period. When the temperature dropped to 65° F., only the bumble bees and honey bees were observed flying, although the other insects had been very active at high temperatures earlier in the day. At 60° F. honey bee activity had practically ceased, but the bumble bees were still working.

Though it was the intention to exclude all insects from the cages covered with cloth, a few small insects such as leaf bugs, leaf hoppers, plant lice and flies were observed on the plants. It is probable that these small insects were sheltering among the plants or in soil when the cloth cages were placed over the plants.

Results—Clover plants under only 3 of the 16 cloth cages produced seed, the average number of seeds per head being 2, 2 and 3, respectively (Tables 1 and 2). In one case the plants in an adjacent alsike screen cage containing a single bumble bee produced an average of 48 seeds per head. It is evident that the blossoms of June and alsike clover are not automatically self-pollinating but require some agency, such as honey bees, to transport pollen from stamens to stigmas.

In the screen cages a large number of leaf bugs, leaf hoppers, plant lice and flies were observed. These insects apparently do not effect pollination of clover as no seed were set in these cages, except when either a bumble bee or honey bees were present in them (see Table 1, 2 and 3).

That bumble bees effect pollination is shown in Table 2. One bumble bee was confined in each of three screen cages over alsike clover and seeds were set in a number of heads of clover in each cage. Many heads of alsike clover in these cages contained no seeds, however, indicating that the bumble bees were erratic and failed to visit many blooms, although confined to the cages throughout the blooming period. In the open field, bumble bees usually flew farther between visits to blooms than did honey bees under similar conditions. This characteristic, together with the scarcity of bumble bees in the district, indicates that bumble bees cannot be relied upon to pollinate enough blossoms to produce a heavy seed set.

The small wild bees were comparatively few in number. Although the mesh of the wire screen cages was large enough to permit the smaller species of bees to enter the cages, none were observed working on blossoms in any cage. The fact that some of these small wild bees were observed gathering pollen indicates that they may effect pollination to some extent. However, due to the relatively small numbers present and their inactivity during adverse weather conditions, it is probable that they cannot be

depended upon to pollinate a sufficiently large number of blossoms to produce a heavy yield of seed.

The data presented in Table 1 show that honey bees are very effective in increasing the production of June clover seed. Seed production was insignificant in the cages, both cloth and screen, where the honey bees were excluded. Of course bumble bees and perhaps other large insects could, and did, effect a certain amount of pollination of the blossoms in the field (next to last column in Tables 1 and 2), but their observed scarcity indicates that they were relatively unimportant as com-

TABLE 1—RESULTS OF POLLINATION EXPERIMENTS WITH JUNE CLOVER.

Distance from honey bee colonies.		Average number of seeds per head.			
		Cloth cage without honey bees.	Screen cage without honey bees.	Field with honey bees.	Screen cage with honey bees.
Welsh—1930	½ rod	0	0	103	
	20 rods	0	0	106	
	80 rods west	*	0	103	
	80 rods north	0	0	102	
	120 rods north	0	0	79	
Welsh—1931	½ rod	0	*	56	46
	20 rods	0	6	51	
Osborn—1930	1 rod	2	0	68	
	30 rods	0	0	61	
Stalwart—1931	½ rod	0	0	39	

* Cage removed.

pared with the honey bees. Furthermore, the fact that a satisfactory yield of June clover seed was secured in the screen cage where the colony of honey bees was so placed that the bees had free access to the clover blossoms within the cage, while bumble bees and other large insects did not, is entirely convincing evidence in this connection.

TABLE 2—RESULTS OF POLLINATION EXPERIMENTS WITH ALSIKE CLOVER.

Distance from honey bee colonies.		Average number of seeds per head.			
		Cloth cage without honey bees.	Screen cage without honey bees.	Field with honey bees.	Screen cage with honey bees.
Wallis farm—1930	½ rod	0	0	62	
	15 rods	2	48*	27	
	40 rods	0	Cage removed	29	
	80 rods	0	0	30	
Wallis farm—1931	1 rod	0	20*	38	18
	80 rods	0	1	29	
	160 rods	3	34*	35	

* Bumble bee in cage.

The results with alsike clover, shown in Table 2, correspond very closely with those in Table 1 with June clover. Seed was produced in neither the cloth nor screen cages when the honey bees were excluded.

Seed production was very materially increased by the presence of bumble bees and honey bees in the screen cages. The field checks where both bumble bees and honey bees had access to the blossoms produced seed freely.

The total number of alfalfa seed produced on an equal area was far greater on the field check plot and under the wire cage with honey bees than under the cloth cage and wire cage where honey bees were

TABLE 3—RESULTS OF POLLINATION EXPERIMENTS WITH ALFALFA—OSTRANDER, 1931

Distance from honey bee colonies—½ rod.	Number pods on an area of 9 square feet.	Total number of seeds on an area of 9 square feet.
Cloth cage, no honey bees	22	32
Wire cage, no honey bees	96	283
Wire cage with honey bees	1,142	4,323
Field check plot	1,311	5,863

excluded. The pollinating activity of the honey bees resulted in an enormous increase in both alfalfa pod and seed setting.

A field survey was conducted to determine the relative yields of fields freely and those not freely visited by honey bees.

TABLE 4—FIELD SURVEY.

ALSIKE CLOVER—1930.

Field number.	Colonies of bees.	Distance from field.	Acres.	Yield in bushels of seed.
1	70	1 mile west	23	6.4
2	5	Adjacent	10	5.8
3	5	¼ mile east	14	5.4
4	None near		4	2.2
5	None near		240	3.8

1931.

6	70	½ mile west	52	5.4
7	25	¼ mile west	16	4.7
8	25	Adjacent	18	4.6
9	70	2 miles north	3	3.0
10	None near		13	3.2

JUNE CLOVER—1931.

11	5	Adjacent	20	5.7
12	23	¼ mile east	3	4.9
13	5	2½ miles west	15	0.0

This was made in the vicinity of Rudyard, Chippewa County, where clover seed is one of the important cash crops. There is one fairly large apiary near Rudyard and it has become the practice of this beekeeper

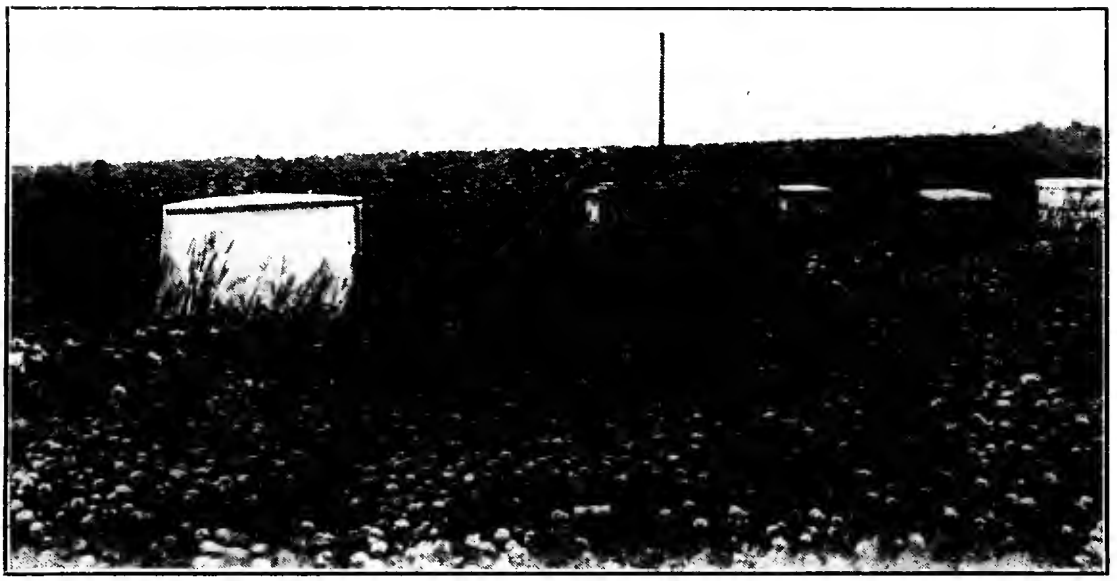

Figure 1—This photograph shows the construction of the 3-ft. x 3-ft. cages covered with nainsook and wire screen that were placed over clover and alfalfa plants at different distances from colonies of honey bees.

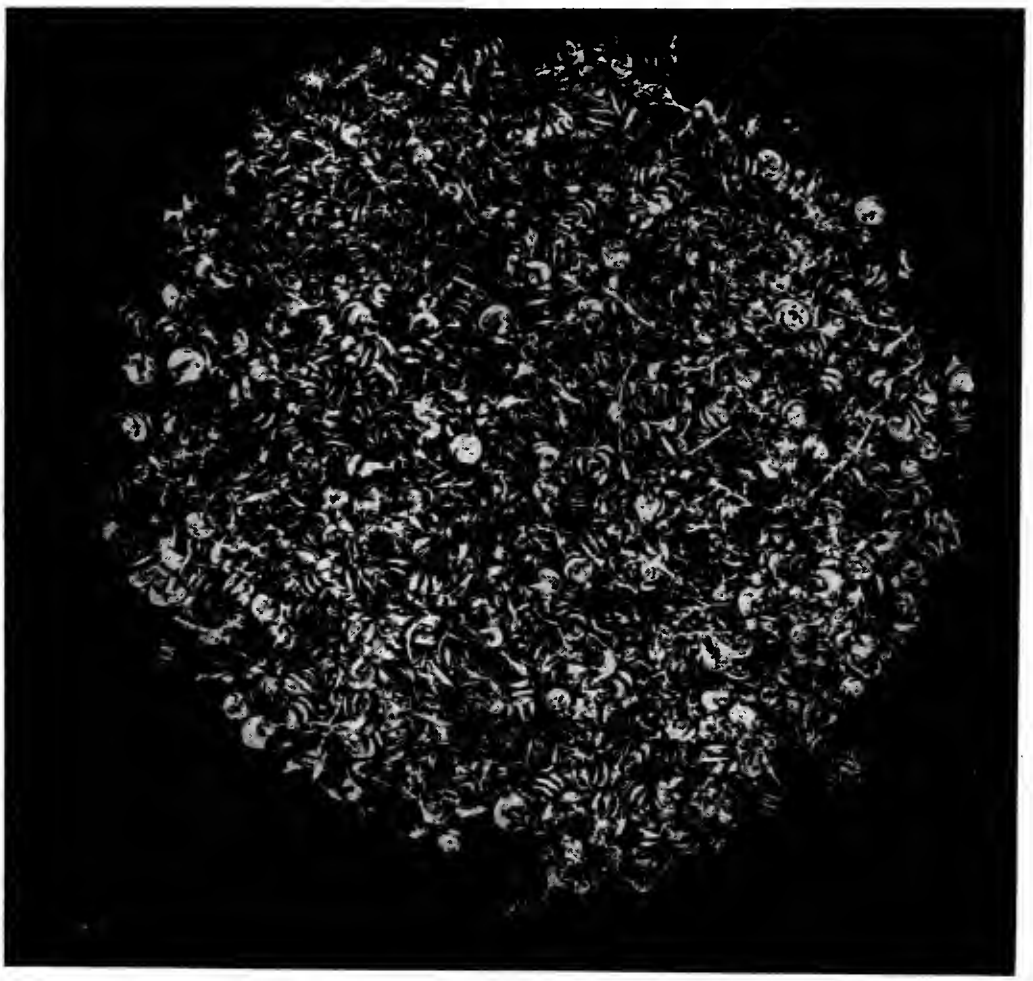

Figure 2—The alfalfa seed pods gathered from a representative area three feet square to which honey bees and other bees had free access during the blossoming season. Note the large number of pods and compare with Figures 3, 4 and 5, more especially 4 and 5.

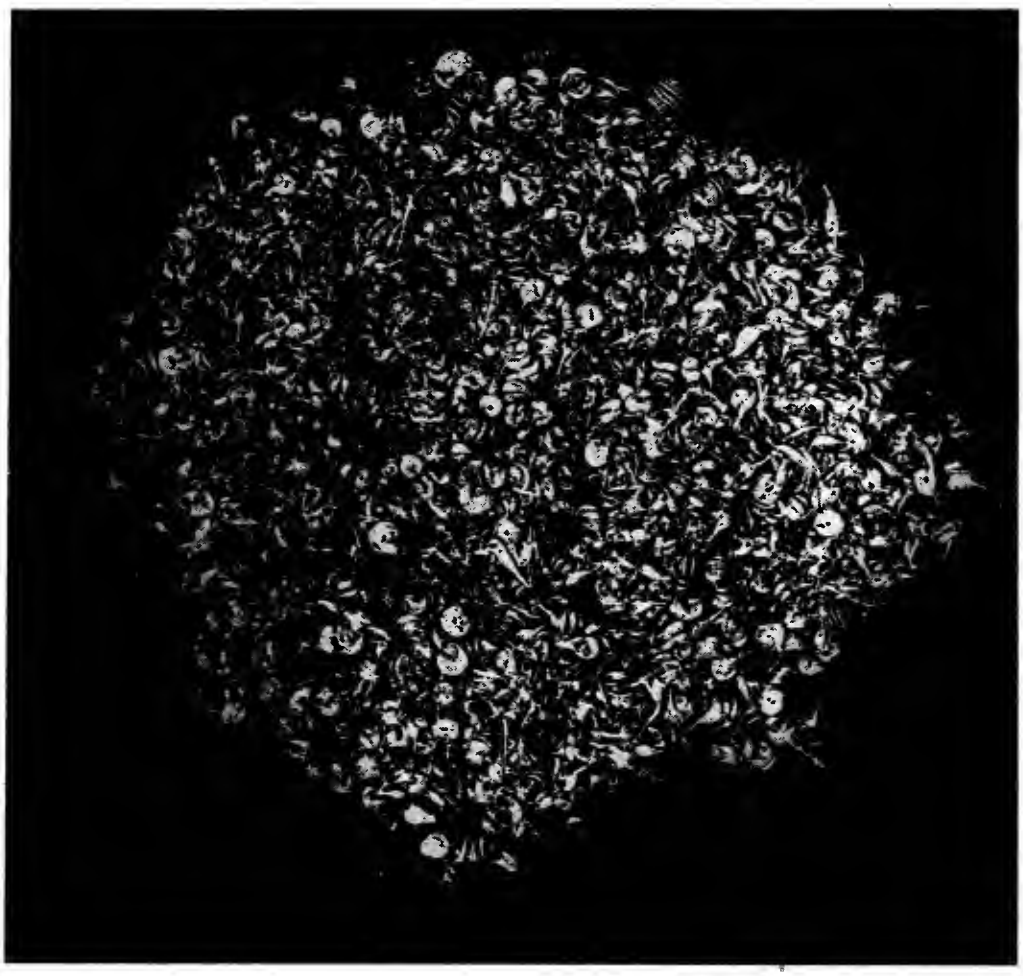

Figure 3—The alfalfa seed pods gathered from an area of three feet square covered with a fine mesh wire cage but inside of which honey bees were introduced during the blossoming season. Bumble bees and other large insects were kept out of this cage. Note the large number of seed pods and compare with Figures 2, 4 and 5, more especially 4 and 5.

Figure 4—The alfalfa seed pods gathered from an area of three feet square covered with a fine mesh wire cage during the blossoming season to keep out honey bees and other large insects. Note the small number of pods—and they were poorly filled with seed—as compared with Figures 2 and 3.

Figure 5—The alfalfa seed pods gathered from an area of three feet square covered with a nainsook cloth screen during the blossoming season to keep out not only honey bees but smaller insects that conceivably might assist in pollination. Note the small number of pods as compared with Figures 2, 3 and 4.

to place colonies with farmers during the nectar gathering season, though if forced to do so bees will travel considerable distances in order to obtain nectar. However, if nectar is abundant the flying range is usually less than two miles. The fields included in this survey were regarded as comparable from the standpoint of soil fertility, condition and stand of plants. In no case did the fields visited only sparingly by honey bees equal in seed production comparable fields freely visited by them. Obviously the honey bees were effective in increasing the yields per acre of both alsike and June clover seed.

Conclusions.

1. Small insects, such as bugs (Hemiptera) and flies (Diptera), that are present in large numbers in clover and alfalfa fields apparently do not serve as pollinating agents and are of little or no value in contributing to a setting of pods and seeds.

2. Bumble bees are effective pollinating agents, but, due to their relative scarcity in the clover and alfalfa seed producing districts of northern Michigan cannot be depended on for pollination purposes.

3. The honey bee was found to be a very effective pollinating agent for June and alsike clovers and for alfalfa and the presence of large numbers of bees resulted in marked increases in the seed crops of these legumes.

TEMPERATURE GRADIENT IN THE EGG-LAYING ACTIVITIES OF THE QUEEN BEE.*

(W. E. DUNHAM, Ohio State University.)

INTRODUCTION.

It is generally thought that the hive temperature at which the queen is stimulated to start her egg-laying activities in early spring is about 93 degrees F. One might gather from this that when brood-rearing has once been stimulated the above temperature is maintained in the brood nest, and that the queen is rather fixed in responding by egg-laying at any other than the temperature stated. It was because of some doubt concerning this idea that this study of the gradient in egg-laying was undertaken.

The writer wishes to express his appreciation to Professor Herbert Osborn for his helpful suggestions on this work.

APPARATUS.

The thermocouple method of taking temperatures lends itself admirably to this type of work. The use of these instruments avoids any abnormal reactions which might result in stimulating the colony and thus causing a higher temperature which was often the case in the old method of taking temperatures with mercuric thermometers. Also the readings are accurate and almost instantaneous.

A two pound package of bees with an untested queen was placed in a four frame vertical observation nucleus. Before any study was undertaken, the bees were left long enough so that they had become fully adjusted to their environment and had begun brood-rearing. The four frame vertical observation nucleus consisted of four Hoffman frames placed one above the other. The sides of the observation nucleus were of glass. On each side of each frame were three thermocouple junctions inserted through the glass, making six junctions for each frame and twenty-four for the entire nucleus. (See Fig. 1, for arrangements of the thermocouple junctions). This observation nucleus was placed in a dark room where the temperature was quite constant. Red lights, to which bees made no abnormal response, afforded illumination for the worker to carry on his observations. An extension of the entrance of the observation nucleus was made which led to the outside of the building and thus allowed flight activities for the bees.

* Reprinted from The Ohio Journal of Science, Vol. XXX, No. 6.

General Procedure.

Observations on this experiment which were carried on in 1928 were begun on the morning of June 5th and continued through the evening of June 9th. These observations were arranged in three thirty-minute periods daily; one in the morning, one at noon, and one in the evening, so as to obtain a fairly accurate representation of what took place during each day.

Figure 1—General arrangement of apparatus when studying the egg-laying activities of the queen bee.

In the study of the gradient in the egg-laying activity of the queen bee, observations were taken on the amount and position of the brood and the bees; the number of eggs laid by the queen; the exact position of these eggs, and the temperature of the region in which the eggs were laid. After these data had been gathered for the entire period, they were arranged in a temperature gradient table which started at 73 degrees F. and with intervals of 3 degrees (ie. 73-76-79 etc.) culminated at 94 degrees F. At these various temperatures, the number of eggs laid dur-

ing the observation periods were tabulated (Table I). Fig. 2 gives a graphic representation of the tabulated data.

TABLE I.

INFLUENCE OF BROOD NEST TEMPERATURES ON THE EGG LAYING ACTIVITY OF THE QUEEN BEE.

Temperatures Degrees F.	71½° 73°	74½° 76°	etc. 79°	82°	85°	88°	91°	94°
Number of eggs laid by the queen.	0	2	19	34	67	110	96	22

Discussion.

As shown in the table, the egg-laying activity of the queen was carried on from 73 degrees F. to 94 degrees F. thus showing conclusively that after the queen has once started her egg-laying activities in the spring she is not absolutely confined in her egg-laying processes to a rather narrow range of temperatures. However, the temperature range is relatively very narrow at which she responds most actively to egg-laying, as shown in Table I. This region ranges from 88 degrees F. to 91 degrees F. It is interesting to note the gradual gradient from the optimum egg-laying temperature to the lowest egg-laying temperature. Of equal significance is the egg-laying gradient from the optimum temperature to the highest temperature recorded or 94 degrees F. A comparison of the gradient in egg-laying taking place from the optimum to the lowest temperature with that from the optimum to the highest temperature indicates that the fall of the gradient in egg-laying is much greater in the latter than in the former. This is further substantiated in some observations already reported.[1]

During the observation period, other factors were recorded which must be given careful attention in order to make a clear diagnosis of the gradient in the egg-laying of the queen bee. The fact must not be overlooked that this experiment was conducted during the spring when brood-rearing is more intensive than at any other time of the year. When conditions are normal, as was the case in the colony used in this experiment, there is a rapid expansion of the brood-nest. Because of the ability of the queen for heavy egg-laying during the spring period, she not only keeps the area from which brood is emerging filled with eggs, but she also lays eggs on the outer region of the brood-nest, thus constantly increasing the area occupied with brood. It is quite evident that the warmest temperatures will occur in the central region of the brood-nest and that the cooler temperatures at which the queen will lay, will occur at the junction of that portion of the comb unoccupied with brood with that containing brood.[2] Thus it is obvious that when intensive brood-rearing is going on which results in a rapid expansion of the brood-nest, the gradient in egg-laying from the optimum temperature to the low extreme will cover a wide range.

[1] Dunham, W. E. The Relation of Heat to Brood Rearing. Gleanings in Bee Culture. 57: 359-362. June, 1929.

[2] Dunham, W. E. The Influence of External Temperature on Hive Temperatures during the Summer. Journ. Econ. Ent., 22: 798-800. 1929.

Having made a detailed study of the egg-laying gradient for this particular period of the year, certain correlations are suggested. Nolan's work brings [3] out very conclusively that there are definite phases in the brood-rearing curve during different parts of a year. In brief, he found that there are three distinct phases of the curve, which are: the initial brood-rearing phase, the major brood-rearing phase, and the contraction brood-rearing phase. Following the latter is a broodless period.

The initial brood-rearing phase begins early in the spring and follows the broodless period which might be termed a semi-dormant phase. In

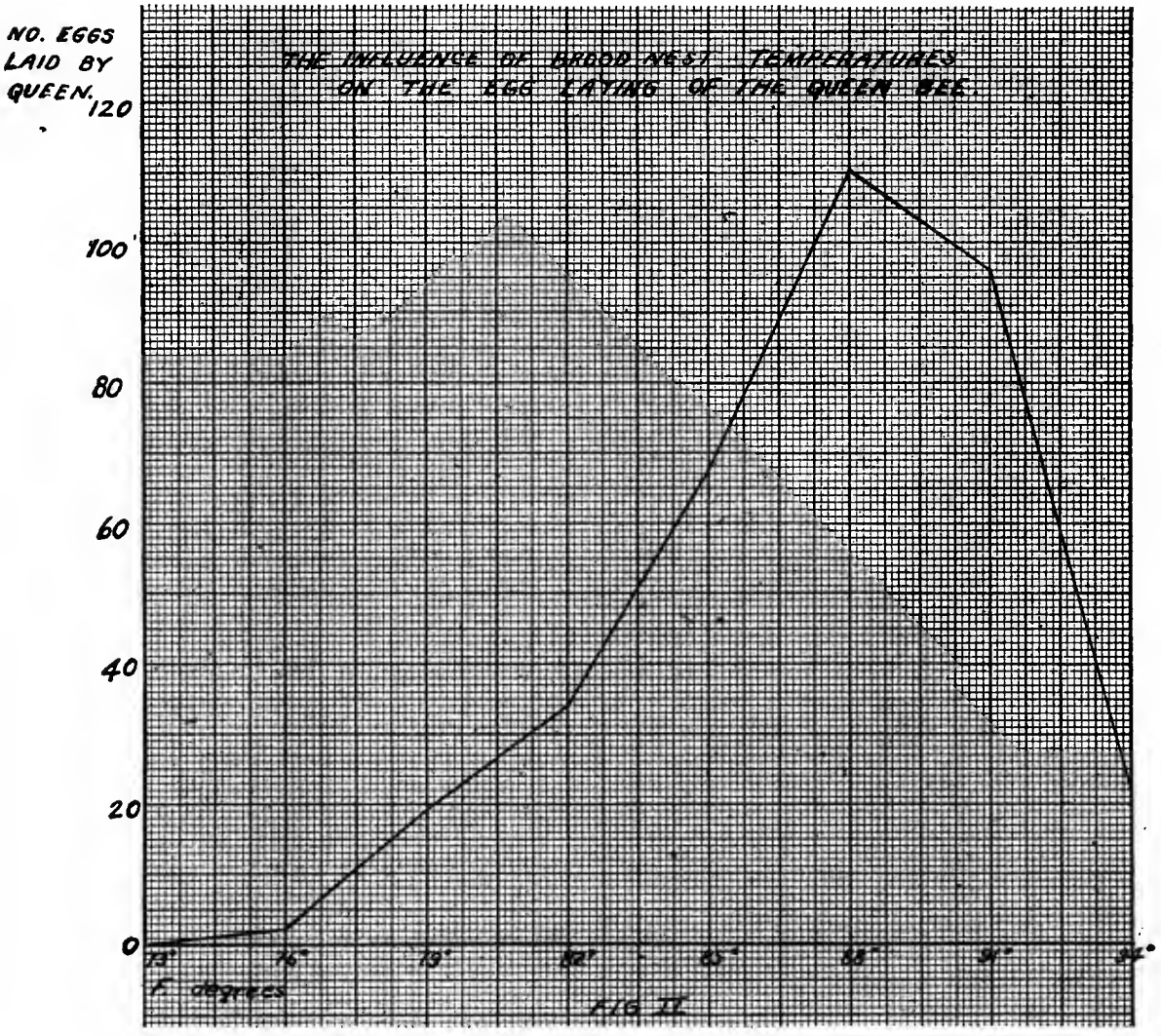

Figure 2.

comparing the amount of brood present at this time with the number of bees to care for it and maintain the other activities of the hive, it is obvious that the ratio of the number of bees to the amount of brood is very high. As a result, the temperature where the queen begins laying would be quite constant. This would mean, then, that the temperature gradient in egg-laying would be confined to a small area with a slight

[3] Nolan, J. W. The Brood Rearing Cycle of the Honey Bee. U. S. Dept. Agric. Bul. No. 1349.

temperature range. However, as the brood-nest becomes more and more expanded during this initial brood-rearing period, the range in the temperature gradient in egg-laying would become increasingly greater. The reason for this is that, as the brood-nest is rapidly expanding, the ratio of the number of individual bees to care for the increasing brood area and carry on the other activities of the hive becomes less and less. When this ratio has reached its extreme, the temperature gradient in egg-laying from the optimum temperature to the low temperature will reach its widest range. As the brood emerges, and the ratio of the number of individual bees to care for the brood and the duties of the hive increases, the range in the temperature gradient of egg-laying becomes increasingly less. Also correlated with the increasing number of bees in a hive is an increase of the temperature in the central upper portion of the brood area to more than the optimum temperature regardless of the activities of the bees which tend to hold the temperature rather constant. The fact must not be overlooked that some heat is given off by the brood due to its metabolic activity.

Another interesting correlation occurring during the initial brood-rearing period is the difference between weak and strong colonies in the temperature gradient in egg-laying. In weak colonies this gradient from the optimum temperature to the lowest temperature covers a wider range of degrees and is also extended over a longer period of time than is the case in strong colonies. Because of the small number of bees in weak colonies, the queen soon has the area of the hive filled with brood where the bees are able to maintain a favorable temperature. In such a case, because of the tendency for a rapid expansion of the brood-nest, the queen responds by laying in cooler temperatures than she would otherwise.

The recommendation of beekeeping experts to leave packing on colonies until weather conditions in the spring have become settled, also has a direct influence on the temperature gradient in the egg-laying of the queen bee. With this insulating layer around the hive, the bees are able to maintain the favorable egg-laying temperature over a larger area of the hive, than they could otherwise. This would result then in the temperature gradient in the egg-laying of the queen covering a narrower range from the optimum temperature to the lowest temperature than if the colonies were unprotected and consequently she would lay eggs at a much more rapid rate.

Another interesting phenomenon which takes place during the initial brood-rearing period is that, as one goes northward from the southern states, the intensity of brood-rearing becomes increasingly greater. It has been suggested that the intensity of brood-rearing increases as the length of the broodless period increases. The writer is not in accord with this belief but attributes it to certain other conditions found in the northward regions.

The writer is of the opinion that if a queen were taken from a northern colony where the broodless period had been long and placed at the beginning of the initial brood-rearing period in a colony in the south, that the intensity of brood-rearing and magnitude of the initial brood-

rearing curve would undoubtedly correspond very closely to that of other colonies in the south where the queens had been wintered over with the colony and the broodless period had been short. It has already been shown that if a queen from the south where the broodless period had been short were introduced at the beginning of the initial brood-rearing period to a colony in the north, the intensity in brood-rearing and the magnitude of the initial brood-rearing curve would correspond very closely to that of other colonies in the north where the queen had been wintered over with the colony. A good example of this is the practice among northern beekeepers of sometimes buying from the south, pound packages of bees with a tested queen. The bees are young and have never passed through a broodless period which eliminates any possible argument that over wintered bees factor in the magnitude of the initial brood-rearing curve in the north. However, the queen in order to be of a tested grade and shipped out this early in the season must have been reared the previous year and have passed through a southern winter where the broodless period is short. A package of bees with a tested queen which is shipped so that it begins brood-rearing about the same time as brood-rearing starts in northern colonies, begins brooding just as intensively and the final peak in the initial brood-rearing curve reaches the same magnitude as in northern colonies where the broodless period has been long. It is quite evident then that the length of the broodless period is not the determining factor in the magnitude of the initial brood-rearing curve but that there are other conditions that are present as one goes northward that are not present in the southern states which have a direct bearing on the magnitude of the initial brood-rearing phase. One of the important factors which has a direct bearing to some degree at least on the temperatures that occur within the hive must be external temperatures.

As one goes northward, the temperatures occurring in early spring when brood-rearing starts, increases gradually as the season advances. Thus it requires a longer time before external temperatures occur which are as high or higher than the optimum egg-laying temperature. Because of these cooler conditions, even though the population of the colony increases, there is a longer time for the queen to lay on the lower scale of the optimum egg-laying temperature as well as at the optimum egg-laying temperature. Since the gradient is much slower on this side of the scale, it results in the fact that the initial brood-rearing curve will reach a high magnitude.

In the south one finds a reverse condition. The temperatures occurring in spring when brood-rearing starts, increase quite rapidly as time goes on and so in a short time external temperatures occur which are as high or higher than the optimum egg-laying temperature. Because of these higher temperatures along with the increased population of the hive, there is a large portion of the hive where the temperature is on the higher scale of the optimum egg-laying temperature. Since the gradient is much more rapid on this side of the scale, the initial brood rearing curve will not reach a high magnitude.

SOME COMPARATIVE DATA ON MOISTURE IN TOP AND BOTTOM LAYERS OF HONEY AFTER A YEAR OF STORAGE, AS INDICATED BY THE VACUUM DRYING OVEN AND THE REFRACTOMETER.*

(By G. E. Marvin and H. F. Wilson)

Abstract.

In taking samples of honey for moisture determination, the samples must be thoroughly mixed for during the process of crystallization there is shown to be a distinct variation between the amount of moisture in the top and bottom layers and the moisture content of the top layer is always greater than the bottom layer.

During the course of our work on fermentation of honey an occasion arose where it became necessary to know the moisture content of the top and bottom layers of 36 samples of honey, 12 samples having been stored in each of 3 temperature chambers held at 40, 60, and 80°F. respectively for a year. The moisture content was determined by two methods (1) Vacuum drying oven on quartz sand (2) Abbé Refractometer. Aside from the facts in question on fermentation, other interesting sidelights developed of which we shall present a few.

Method.—The samples of honey that were used in this study were taken from the beginning of the honey flow June 26 to October 17, 1929. In taking the samples, the extractor and honey tank were cleaned with boiling water and then thoroughly dried. The honey was strained through 3 thicknesses of cheesecloth, just as it ran from the extractor and bottled immediately in sterilized bottles, which were sealed upon filling, labelled and put in the dark constant temperature chambers.

Sample	Date of Extraction	Condition of capping
1	June 26	Entirely uncapped
2	July 3	About 1/6 of comb surface capped over
3	July 10	About 1/4 of comb surface capped over
4	July 17	About 2/3 of comb surface capped over
5	July 24	About 3/4 of comb surface capped over
6	July 31	Few uncapped cells along bottom
7	August 7	Entirely capped
8	August 7	Entirely uncapped
9	August 14	Entirely uncapped
10	August 14	Completely capped
11	October 10*	Completely capped
12	October 17*	Completely capped

*Removed from hive on September 15. Stored in warm dry room until period of extraction.

The honeys were carefully removed from their storage chambers so as not to mix the two layers in uncrystallized samples. The top ¼ of the honey in each bottle was spooned off into a dry wide mouthed bottle and corked; the middle layer was then removed leaving the bottom ¼ in

* Reprinted from Journal of Economic Entomology, Vol. 25, No. 3, June, 1932.

which we were interested. The top and bottom samples were then melted up in a water bath at 50°C. and the liquid honey used for moisture determinations.

The official method recommended by the Association of Agricultural Chemists for determining this is a long slow process requiring special appartus and technique. One is required to use pure quartz sand which will pass a 40 mesh but not a 60 mesh screen, then digest the sand in HCl and wash free from acid, dry and ignite. Twenty-five to thirty grams together with a short glass stirring rod are placed in a flat bottomed aluminum drying dish of 60 mm. diameter. This dish with contents is then dried in an oven, cooled in a desiccator and weighed. A quantity of honey sufficient to yield approximately 1 gram of solids is poured on the weighed sand and reweighed to the 4th decimal place to get the exact amount of honey. One cubic centimeter of distilled water is added to help incorporate the honey with the sand. Samples are run in duplicate and then put in the vacuum oven at 70°C. under a pressure not to exceed 100 mm. of mercury for 15 to 17 hours. After drying the samples for this time, the pump is stopped and the oven brought to atmospheric pressure with dry air. The dishes are cooled in a desiccator and weighed, then put back in the oven for a further drying period of two hours after which they are removed again, weighed and if the change in weight does not exceed 2 mg. the loss in weight from the original is reported as the per cent of moisture.

The apparatus required by this method of obtaining the moisture content of honey is (1) a low speed motor and vacuum pump which is able to run 17 or 18 hours at a stretch, (2) an electric vacuum oven (3) a sensitive balance weighing to the 4th decimal place (4) aluminum flat bottom drying dishes and (5) desiccator, together with various other minor equipment.

Abbé Refractometer.—Diffused daylight was used as the source of light for these readings. Water was circulated through the prisms, keeping them at 20°C. for if other temperatures are used, corrections must be made. The double prisms were opened and a few drops of honey put on them by means of a glass stirring rod.

The method of measurement is based upon the observation of the position of the border line of total reflection in relation to the faces of the prism of flint glass. This border line is brought into the field of the telescope by rotating the double prism until the field of vision is divided into a light and a dark portion. The line dividing these portions is the border line and as a rule will not be a sharp line but a band of color, but by rotating the compensator, a sharp, colorless line is obtained. The border line should be adjusted so that it falls on the point of intersection of the cross hairs, after which the refractive index of the honey should be read directly on the scale of the sector. By the use of Schönrocks table one is able to obtain the per cent of water found in a sugar solution with that refractive index—no table having been worked out for honey.

This method is extremely easy and the only apparatus required is an Abbé refractometer with a supply of water kept at a constant temperature.

TABLE 1—MOISTURE IN TOP AND BOTTOM LAYERS OF HONEY STORED IN 40° F. CHAMBER AS DETERMINED BY VACUUM OVEN AND REFRACTOMETER.

Sample.	Oven.	Top refractometer.	Difference.	Oven.	Bottom refractometer.	Difference.	Difference top and bottom.		Type of granulation.
							Oven.	Refractometer.	
1	19.71	21.8	2.09	15.94	18.2	2.26	3.77	3.6	Coarsely granulated; a little liquid on surface.
2	17.20	20.0	2.80	16.86	19.4	2.54	.34	.6	Coarsely granulated; a little liquid on surface
3	17.50	20.0	2.50	16.93	19.2	2.27	.57	.8	Fine granulation; dry.
4	18.51	21.0	2.49	17.44	20.0	2.56	1.07	1.0	Fine granulation and dry as in 3.
5	16.46	19.1	2.64	16.06	18.6	2.54	.40	.5	Fine granulation and dry as in 3.
6	17.15	19.3	2.15	16.42	18.7	2.28	.73	.6	Fine granulation and dry as in 3.
7	18.42	20.8	2.38	16.94	19.3	2.36	1.48	1.5	
8	20.59	22.8	2.21	18.87	21.2	2.33	1.72	1.6	Like 1 and 2.
9	22.45	24.0	1.55	20.55	22.5	1.95	1.9	1.5	Like 1 and 2.
10	18.94	21.2	2.26	17.67	20.0	2.33	1.27	1.2	Fine granulation and dry as in 3.
11	16.05	18.3	2.25	15.86	18.3	2.44	.19	0	Very fine granulation creamy appearance.
12	16.55	18.9	2.35	16.18	18.6	2.42	.37	.3	Very fine granulation creamy appearance.

It is not our purpose to discuss the relative merits of the two methods of determining the moisture in honey but to present our results and to encourage further work in this connection with a method which seems to have promise.

Table 1 shows the moisture reading of the top and bottom layers of honey stored in the 40°F. chamber by the two methods. Differences in moisture between the two layers ranged from .19 to 3.77 per cent for the honeys dried in the vacuum oven and 0 to 3.6 per cent on the refractometer. In all cases the refractometer moisture readings were above the moisture readings obtained by the vacuum drying oven method. The differences in the case of the readings of the top layer by the two methods ranged from 1.55 to 2.80 per cent and for the bottom layer readings from 1.95 to 2.56 per cent.

Table 2 shows the moisture reading of the top and bottom layers of honey stored in the 60° chamber by the same two methods. Differences in moisture between the two layers ranged from .65 to 3.15 per cent for the honeys dried in the vacuum oven and .7 to 3.6 per cent on the refractometer. As with the samples before, the refractometer moisture readings were above the moisture readings obtained by the vacuum drying oven method. The differences in the case of the readings of the top layer by the two methods ranged from 1.70 to 2.62 per cent and for the bottom layer readings from 1.48 to 2.64 per cent.

Table 3 shows the moisture readings of the top and bottom layers of honey stored in the 80°F. chamber by the same two methods. The moisture in the two layers did not show the variation that the honey did when stored in the 40 and 60°F. chambers. Two samples, 11 and 12, showed a slightly greater moisture content by the oven drying method in the bottom layer than the top. The first sample which was entirely uncapped still showed a high variation of 3.73 per cent between the moisture of the two layers. Outside of these three samples by the oven method of drying, the moisture ranged from .49 to 1.3 per cent and .2 to 1.7 on the refractometer. As with the samples before, the refractometer moisture readings were above the moisture readings obtained by the vacuum drying oven method. The differences in the case of the readings of the top layer by the two methods ranged from 1.82 to 2.63 and for the bottom layer readings from 1.82 to 4.19.

Discussion.—From the constant difference between the moisture readings obtained by the two methods, it appears that some factor can be worked out, or a table constructed on which one can read the correct moisture in honey by the refractometer. In this way a few minutes will be consumed where over 24 hours are required to obtain the moisture by the vacuum drying oven method.

Our work has shown us that in taking a sample of honey for moisture determination it is very important that the two layers be thoroughly mixed. Also it is not advisable to take a sample from the top of a can to show to a prospective buyer, for honey thoroughly mixed will have a better body. Just recently a discussion came up when it was proposed to take a sample from the top of 60 lb. cans to find out if the honeys

TABLE 2—MOISTURE IN OP AND BOTTOM LAYERS OF HONEY STORED IN 60° F. CHAMBER AS DETERMINED BY VACUUM OVEN AND REFRACTOMETER.

Sample.	Oven.	Top refractometer.	Difference.	Oven.	Bottom refractometer.	Difference.	Difference top and bottom.		Type of granulation.
							Oven.	Refractometer.	
1	21.38	24.0	2.62	19.0	21.6	2.60	2.38	2.4	Upper ½ liquid. Lower coarsely granulated.
2	19.50	21.2	1.70	17.02	19.3	2.28	2.48	1.9	Coarsely granulated; liquid between crystals ½ inch liquid on top.
3	20.16	21.9	1.74	16.67	18.9	2.23	3.39	3.0	Smaller crystals than above—rest same.
4	19.74	21.6	1.86	17.43	19.7	2.27	2.31	1.9	Like 2.
5	17.73	20.0	2.27	16.42	18.9	2.48	1.32	1.1	Semisolid—coarse crystals.
6	18.32	20.2	1.88	16.54	19.0	2.46	1.78	1.2	Semisolid—coarse crystals.
7	17.64	20.0	2.36	16.99	19.3	2.31	.65	.7	Very fine granulation.
8	22.09	24.0	1.91	18.92	21.4	2.48	3.17	2.6	Medium coarse crystals; 1/6 liquid on top.
9	24.77	26.8	2.03	21.72	23.2	1.48	3.05	3.6	⅔ coarse crystals; ⅓ liquid.
10	21.8	23.8	2.00	18.65	20.8	2.15	3.15	3.0	Very fine granulation complete.
11	16.72	19.2	2.48	15.66	18.3	2.64	1.06	.9	Same as 10.
12	17.68	19.9	2.22	16.18	18.5	2.32	1.50	1.4	Same as 10.

TABLE 3—MOISTURE IN TOP AND BOTTOM LAYERS OF HONEY STORED IN 80° F. CHAMBER AS DETERMINED BY VACUUM OVEN AND REFRACTOMETER.

Sample.	Oven.	Top refractometer.	Difference.	Oven.	Bottom refractometer.	Difference.	Difference top and bottom.		Type of granulation.
							Oven.	Refractometer.	
1	20.84	23.0	2.16	17.11	21.3	4.19	3.73	1.7	Upper ½ liquid. Lower coarsely granulated.
2	18.01	20.1	2.09	16.73	19.1	2.37	1.28	1.0	Upper 1/5 liquid; rest coarsely granulated.
3	17.56	20.0	2.44	16.33	18.6	2.27	1.23	1.4	Crystals fine; ¼ inch liquid at top.
4	18.62	20.5	1.88	17.73	20.3	2.57	.89	.2	Coarse crystals from top to bottom; liquid in between.
5	16.88	18.7	1.82	16.30	18.5	2.20	.58	.2	Same as 4.
6	16.84	19.0	2.16	16.35	18.5	2.15	.49	.5	Completely granulated; very fine.
7	16.47	19.1	2.63	15.73	18.8	3.07	.74	.3	Same as 6.
8	20.98	22.8	1.82	19.68	21.5	1.82	1.3	1.3	Coarse crystals 1/8 inch liquid on surface.
9	22.37	24.4	2.03	21.72	23.8	2.08	.65	.6	¼ medium coarse crystals; rest liquid.
10	18.92	21.2	2.28	17.76	20.0	2.24	1.16	1.2	Coarse granulation; 1/8 inch liquid on surface.
11	15.63	18.1	2.47	15.92	18.2	2.28	—.29	—.1	Medium coarse granulation complete.
12	16.06	18.3	2.24	16.07	18.3	2.23	—.01	0	Same as 11.

came up to the standard weight per gallon. A method of sampling such as this would not be fair as shown by the tables, for in granulating there is bound to be a separation with the lighter honeys rising to the top.

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RELATION OF COMMERCIAL HONEY TO THE SPREAD OF AMERICAN FOULBROOD.[1]

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INTRODUCTION.

The relation and importance of commercial honey to the spread of American foulbrood of bees has occupied the attention of the beekeeping industry more or less prominently for many years. The theory has been promulgated that honey which has not come from disease-free apiaries is dangerous because of the possibility of its disseminating American foulbrood. A few states and at least one foreign country require that honey intended for interstate shipment be accompanied by a certificate from the bee inspector of the state in which the honey originated to the effect that such honey was produced in apiaries free from American foulbrood.

It is a well-established fact that honey taken directly from the combs of the brood chambers of colonies affected by American foulbrood is capable of producing the disease if fed to healthy colonies. Since commercial beekeeping practice bans the extracting of honey from the brood nest, it is difficult to understand how heavily infected honey, in large quantities, could get on the market. Whether honey from supers that have been on colonies affected with American foulbrood is of serious importance in transmitting the disease is still open to question. White *(30, p. 35)*[3] says: "The likelihood that the disease will be transmitted by combs from diseased colonies, which contain honey but no brood, probably is frequently overestimated." On the other hand, Millen *(23)* found that combs built from foundation and completely filled above an excluder with honey from colonies that had been destroyed by American foulbrood produced disease in all of 10 colonies made from package bees to which one comb each of the honey had been given. Corkins *(8)* expressed the belief, as a result of preliminary studies, that "Extracted honey produced above an excluder in a colony in the early stages of American foulbrood is insignificant in the spread of this disease through

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[3] Reference is made by number (italics) to Literature Cited, p. 151 and 152.

commercial honey." The conflicting nature of these observations emphasizes the need for further research before the certification of honey is required as a means of alleviating the foulbrood situation.

In both animal and plant disease bacteriology it is known that pathogenic microorganisms may vary considerably, even within individual species, in virulence and in ability to produce disease. Furthermore, as stated by Zinsser *(31, p. 188-189)*—

> **Whether or not infection occurs depends also upon the *number of bacteria* which gain entrance to the animal tissues. A small number of bacteria, even though of proper species and of sufficient virulence, may easily be overcome by the first onslaught of the defensive forces of the body. Bacteria, therefore, must be in sufficient number to overcome local defenses and to gain a definite foothold and carry on their life processes, before they can give rise to an infection. The more virulent the germ, other conditions being equal, the smaller the number necessary for the production of disease. The introduction of a single individual of the anthrax species, it is claimed, is often sufficient to cause fatal infection; while forms less well adapted to the parasitic mode of life will gain a foothold in the animal body only after the introduction of large numbers.**

In the case of American foulbrood the quantity of infectious material that honey must carry in order to produce disease in a colony has never been determined. White *(30, p. 20, footnote 1)* states, in connection with inoculating healthy colonies experimentally with *Bacillus larvae:*

> **It was found that less than one scale is sufficient disease material to produce a considerable amount of disease in the colony. In some experiments one scale, therefore, might supply all the spores needed although the use of a somewhat greater quantity of material is advisable in most instances.**

While infected honey no doubt does become mixed with disease-free honey, it is probable in many cases that, because of the practice of using large settling and storage tanks, infected honey would be so diluted with spore-free honey as to make the spore content insufficient to produce infection even if fed to healthy bee larvae. Therefore, one object of these investigations was to determine the minimum number of spores of *Bacillus larvae* in honey necessary to produce American foulbrood in healthy colonies of bees as correlated with the infectivity or spore content of the average commercial honey.

In order to obtain information relative to this subject, experiments were conducted in the apiary over a period of five years. In these experiments honey or sugar sirup with a known content of spores of *Bacillus larvae* was fed to healthy colonies and the minimum number of spores that would produce infection was determined. At the same time laboratory studies were carried on with cultures of spores of *B. larvae,* concerning certain growth phases of the organism, particularly the minimum number of spores that would produce vegetative growth on artificial culture media. Methods for demonstrating the presence or absence of spores of *B. larvae* in samples of commercial honeys were also investigated, and these honeys were studied in relation to their infectiousness as correlated with the spore-feeding experiments. These three phases of the investigation will be discussed in the order mentioned.

Minimum Number of Spores of Bacillus Larvae Necessary to Produce Disease in Healthy Colonies of Bees.

METHODS OF PROCEDURE.

Location of Experiments.

These investigations were started during the summer of 1926 in a small experimental apiary located about half a mile from the bee culture larboratory of the Bureau of Entomology at Somerset, Md. The location at Somerset was undesirable, however, because of its close proximity to the apiary connected with the laboratory and to other privately owned colonies of bees, necessitating extreme precautions to prevent spread of the disease. In 1927 the experimental work was transferred to the Intermountain States bee culture field laboratory at Laramie, Wyo.[4] In Wyoming an ideal isolated location was found about 14 miles east of Laramie in the Medicine Bow National Forest, the nearest colonies of bees being at least 14 miles away and probably farther. Since this location is more than 8,000 feet above sea level, there is only a slight nectar flow from wild flowers, which assures the immediate use of any inoculated sirup fed to colonies of bees. In fact, after the middle of the summer it was found necessary in most cases to feed the experimental colonies with uninoculated sugar sirup in order to prevent starvation.

In 1927 and 1928 the colonies used for experimentation were located in two yards between a quarter and a half mile apart. The arrangement of the colonies in the two yards was such as to prevent drifting as much as possible. In 1929 and 1930, in order to limit still further the danger of transmission of disease because of drifting or robbing, 20 colonies were stationed in pairs, so arranged as to minimize the danger from drifting, in 10 isolated locations at least a quarter of a mile apart.

MAKE-UP OF COLONIES.

Five-frame nucleus hives were used for the spore-feeding experiments. The colonies were prepared either with two or three frames of brood, honey, and adhering bees taken from healthy colonies, together with a young laying queen, or, as in 1927, 1928, and 1929, by placing a 2-pound package of bees containing a laying queen on foundation or on combs containing honey from healthy colonies and feeding them sugar sirup. During a good honey flow these small colonies were allowed to build up in the apiary connected with the laboratory until they consisted of three or four frames of brood before they were moved to the isolated locations. The bees making up the colonies used for the feeding experiments from 1927 to 1930 at Laramie, Wyo., were all from the same general strain.

MATERIAL USED FOR INOCULATION.

Spores of *Bacillus larvae* were obtained from American foulbrood scales in combs taken from diseased colonies located in the states of Maryland, Iowa, and Wyoming. The strain used at Somerset, Md., was obtained from a sample sent to that laboratory for diagnosis. Two different strains were used at Laramie during 1927, 1928, and 1929, one

[4] This laboratory is maintained cooperatively by the University of Wyoming and the U. S. Department of Agriculture.

obtained from a diseased colony in the experimental apiary belonging to the University of Wyoming and one obtained from a beekeeper at Lander, Wyo. In 1930 three other strains were used in the feeding experiments, one from Iowa and two from apiaries in Wyoming.

PREPARATION OF SPORE SUSPENSIONS

In preparing the spores for feeding to the healthy colonies, scales were removed from the combs by means of sterile forceps (the necessary precautions being taken against contamination) and placed in a flask containing 50 cc of sterile water and glass beads. After the scales had softened in the water, the flask was shaken for one-half hour to insure complete maceration of the scales. The suspension was then filtered through two thin layers of sterile absorbent cotton into another sterile flask in order to remove any lumps or débris.

In preparing the stock suspensions of spores, at first 75 to 100 scales were taken by counting. Later it was found that the average American foulbrood scale weighs 0.0223 g. Therefore, the 100 scales for the stock suspensions were obtained by weight, the scales being weighed in a sterile covered glass dish before they were deposited in the flask of sterile water.

After the suspension had been filtered and tested for contamination and was ready for use, the number of spores per cubic centimeter was determined by the following method: By means of a blood-diluting pipette giving a dilution of 1 to 20, the spore suspension was diluted with a weak solution of carbol fuchsin and a drop placed in the counting chamber of a Helber bacteria-counting cell 0.02 mm deep and ruled in squares of 0.0025 mm^2 each.[5] With the use of two 15× eyepieces in a binocular microscope and a 1.8-mm oil-immersion objective, the spores in 25 squares of the Helber chamber were counted. Then by means of the formula

$$\frac{\text{Total spores counted} \times \text{dilution} \times 20{,}000 \times 1{,}000}{\text{Number of squares counted}}$$

the approximate number of spores per cubic centimeter in the suspension was determined.

Later this method was checked by the method of Breed and Brew *(2)* for counting bacteria in milk. With the aid of a binocular microscope having two 15× eyepieces and a 1.8 mm oil-immersion objective, the area of a circle etched on an ocular micrometer disk was determined by means of a stage micrometer. One one-hundredth cubic centimeter of a 1 to 100 dilution of the stock suspension of spores was placed on a glass slide on which 1 cm^2 had been ruled with a diamond pencil. This was mixed with a small loopful of carbol fuchsin stain and the whole spread over the 1 cm^2 of surface[5] and allowed to dry uniformly. The number of spores per cubic centimeter of the stock suspension was determined acording to the formula

$$\frac{\text{Area 1 cm}^2}{\text{Area of circular field}} \times \frac{\text{total number of spores counted} \times \text{dilution} \times 100.}{\text{number of circular fields counted}}$$

[5] mm^2 and cm^2 are the abbreviations for square millimeter and square centimeter, respectively, recently adopted by the Style Manual for United States Government printing.

These two methods were found to check fairly closely within the limits of the precision of the methods used in counting. Furthermore, by both methods it was found that in the majority of cases 100 scales in 50 cc of water give aproximately 5,000,000,000 spores per cubic centimeter for each suspension made up in this way. Therefore, this number was used as a standard for making all dilutions.

After a considerable number of counts had been taken in making up several stock suspensions of spores, counting was eliminated and the spore content of the stock suspensions was standardized according to the method described by Gates (*11*, p. 114), as follows: "The opacity of a bacterial suspension is measured by the length of a column of the suspension required to cause the disappearance of a wire loop." An instrument known as a suspensiometer was used for this purpose. The use of this method saved considerable time and labor without appreciably affecting the precision of the counts. One liter of a 50 per cent solution of sugar in water was used as the standard quantity of inoculated sirup fed to each experimental colony. A series of dilutions of the original stock suspension containing 5,000,000,000 spores was made by adding different quantities of the spore suspension to 1 liter of sugar sirup. In this way the approximate total number of spores in each liter of sugar sirup to be fed to colonies of bees was known.

METHOD OF INOCULATING COLONIES.

In 1926 at Somerset, Md., the sugar sirup containing the various dilutions of spores was fed to the colonies by means of galvanized-iron troughs that were hung inside the hives after two combs had been removed. In these troughs sterile excelsior was placed for the bees to walk on in order to prevent them from drowning. This method was found unsatisfactory, however. At Laramie, Wyo., the sugar sirup containing the spores was first placed in Boardman feeders, but owing to the danger of robbing at the entrance of the hives, the method finally used was to invert the jars in holes bored in the hive covers. In this way any leakage into the hives was cleaned up by the bees without danger of causing robbing. To prevent the jars from being broken or knocked over, box covers were placed over them and fastened to the hive covers. Each colony was usually inoculated only once with an individual dilution of spores. Duplicate colonies were inoculated with each dilution of spores. Uninoculated check colonies were placed among those that were inoculated.

PRIMARY OBSERVATIONS.

Observations of the condition of the brood were made at least once a week, and sometimes oftener, after the colony was given the liter of inoculated sirup. In 1926 at Somerset, Md., as soon as diseased larvae appeared in a colony, the colony was killed and at once removed from the apiary. Because of the isolated location near Laramie, Wyo., the colonies were left until the end of the brood-rearing season, when final observations were made.

The results of the spore-feeding experiments are shown in Table 1.

TABLE 1—RESULTS OF SPORE-FEEDING EXPERIMENTS.a

[Duplicate colonies of bees (A and B) were used in the first 4 years, and triplicate colonies (A, B and C) in 1930.]

Total number of spores fed.	Extent of foulbrood in—																		
	1926		1927				1928, repeat.		1928				1929				1930, final.		
			During season.		Final.				During season.		Final.		During season.		Final.				
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	C
5,000,000,000	+	?+																	
2,500,000,000	+	+							+	+	+	+							
1,000,000,000	+	+							+	+	—*	+							
750,000,000	+	+																	
500,000,000	+	+	+		—*				+	+	—*	+	+	+					
350,000,000	+	0	+		+				+		+								
200,000,000	+	?+	+	+	—*	—*	+												
175,000,000			+	?+	+	—*		+											
150,000,000			?+	+	—*	—*	—	—											
125,000,000			0	?+	0	—*	0	—											
100,000,000	0	0	0	?+	0	—*	0	—	+	+	—*	+							
75,000,000			+	?+	—*	—*		+	0	+	0	+	+	0	+	0			
50,000,000	0	0	0	0	0	0			0	+	0	—*	0	+	0	—*	0	0	0
25,000,000													0	0	0	0	0	0	0
10,000,000	0	0											0	0	0	0			
5,000,000													0	0	0	0			
2,500,000													0	0	0	0			
1,500,000													0	0	0	0			
500,000													0	0	0	0			
100,000													0	0	0	0			
Controls	1+, 12–0		1+, 2–0		1+, 2–0		1–0		1+, 3–0		1+, 3–0		8–0		8–0		2–0		

a +, Positive American foulbrood; ?+, probable American foulbrood, very slight and unconfirmed and disappearing by end of brood-rearing season; 0, no disease found during season; —*, disease cleaned out by end of brood rearing; —, no recurrence in second season.

In 1926 a total of 200,000,000 spores fed to a colony was the smallest number that produced disease; in 1927, on the other hand, 75,000,000 was the smallest number. However, in the latter year the spores were obtained from another locality in which environmental conditions were quite different. In an effort to obtain check results, the feeding experiments were repeated in 1928. Through an error in making up the spore dilutions, which was not discovered until too late for rectification, no colony received less than 50,000,000 spores. This season one colony of the pair receiving an inoculation of 50,000,000 spores became infected. The feeding experiments were repeated again in 1929, with dilutions of spores from 75,000,000 down to 100,000—considerably less than the minimum number in 1928. Again only one colony of the pair receiving a total of 50,000,000 became infected. As a result of two years' experiments this was found to be the apparent minimum number of spores of *Bacillus larvae* capable of producing infection when fed in 1 liter of sugar sirup. In 1930 spores from three different localities were fed in duplicate to six healthly colonies in dilutions of 50,000,000 and 25,000,000 without producing disease.

It is therefore apparent that a certain minimum number or mass of spores is required to start the initial action capable of producing American foulbrood in healthy larvae. Under the conditions of these experiments this minimum number was approximately 50,000,000 spores of inoculum per liter of sirup.

Secondary Observations.

During the first three years of the experiments, or previous to 1929, at which time the experimental colonies were isolated in pairs, certain of the uninoculated control colonies developed disease, 1 out of 13 in 1926, 1 out of 3 in 1927, and 1 out of 4 in 1928. It was assumed that the disease was probably not spread by robbing, since no active robbing was observed at any time. In practically every case where a control colony became infected, it was so located in relation to the inoculated colonies that drifting of young nurse bees during play flights could account for the spread of the disease, in one or two cases quite definitely so. In 1929 all eight uninoculated colonies, although they were not located with the inoculated colonies but were within robbing range of all, remained free from disease. The prevention of drifting apparently eliminated the casual spread of disease.

Occasionally a colony of bees affected with American foulbrood will try to clean out the diseased remains, often removing parts of the scales and sometimes actually tearing a comb down to the midrib in order to do this. White (*30, p. 34-35*) states:

> **There is considerable evidence to support the belief that occasionally in cases of light infection the disease may disappear unaided by treatment. * * * It should be emphasized that such a course for the disease, if it occurs at all, is unusual. Although American foulbrood spreads more or less rapidly within an infected colony, the fact remains that it frequently does not.**

Lineburg (*16*) in 1925 reported that in two colonies which were diseased in the spring the disease apparently disappeared later in the season. Three colonies were divided and used for making increase in June and July, but all remained free from disease, at least until the end of that season. Further observations were not reported. Corkins (*8*) in 1928 reported five colonies which were given combs containing scales of American foulbrood at the beginning of the honey flow of 1927 and developed no disease up to July 10, 1928. Two other colonies were observed to have cleaned out the disease and remained healthy for an entire season. However, during the several years of his experimental work on American foulbrood, the writer never observed a colony in which the disease was permanently cleaned out until 1927. In that year, of 16 colonies inoculated with various dilutions of spores, 4 colonies, 2 of which received more than the probable minimum dose causing infection, showed no disease during the season. The disease completely disappeared by the end of brood-rearing in 10 to 12 other colonies that had showed either positive or probable disease some time during the summer. In 1928 package bees were placed on the combs of seven of these colonies that had apparently cleaned out the disease during the previous summer and on two that had been inoculated with presumably a sufficient number of spores but which had remained healthy. Three of the seven developed disease again the second season, while four remained healthy during the entire season. Neither of the two inoculated colonies that had remained free from disease in 1927 developed it in 1928. Of the 11 colonies inoculated in 1928 that developed disease, 4 cleaned up the disease by the end of the brood-rearing season and 2

inoculated colonies showed no disease. In 1929, 1 of the 2 colonies developing disease cleaned up by the end of the brood-rearing season, making a total of 15 cases in which the disease was cleaned up by the end of brood-rearing. Two of the colonies inoculated with the minimum infectious dose or more showed no disease during that summer.

It is possible that, in the high altitude of Laramie, and in similar places where the air is very dry, the scales of American foulbrood become dried without adhering so tenaciously to the cell walls as they do in more humid climates at lower altitudes. These observations indicate the necessity of further work on the resistance of bees to the disease and variation in virulence of different strains of the organism.

Inoculation of Individual Bee Larvae with Definite Numbers of Spores of Bacillus Larvae.

In the light of the results of the foregoing experiments, in which colonies were inoculated with presumably a quantity of spores sufficient to produce infection but in which no disease developed, the question arises as to what became of the spores in the sugar sirup, some of which presumably were fed to healthy larvae. In those colonies developing disease that received a minimum number of spores, how many spores did each larva developing the disease receive? In order to obtain information on these points, a preliminary series of experiments was planned in which individual larvae were inoculated with known numbers of spores.

Toumanoff (*29*) reports that he was unable to cause infection by giving individual larvae a drop of a rich emulsion of a culture of *Bacillus larvae* in salt solution. He found that many of the larvae so treated were removed from the cells by the bees, and those remaining failed to develop disease. He further found that larvae given only uninoculated salt solution were also removed in the same way. Therefore, in the present experiments sugar sirup was used instead of salt solution. In a comb from a healthy colony containing numerous coiled larvae, a drop of an uninoculated 50 per cent solution of sugar in water was placed in each cell containing a larva, as near the mouth parts of the larva as possible. The rim of each cell so treated was marked with a paint consisting of 1 part of liquid white shellac, 1 part of a paint pigment, and 4 parts of ethyl alcohol. The sugar sirup was slightly colored with water-soluble eosin in order to aid in determining the effect. Frequent observations showed that practically all larvae that were fed this colored sugar sirup developed normally and were sealed over, the pigment markings still being present on the edges of the cappings. In most of the cells a residue of colored sirup could be observed for several hours after the larvae had fed.

A series of 5-frame nuclei was prepared, each containing one or two combs having a large number of unsealed larvae. A set of dilutions of spores was made from a stock suspension with a sterilized 50 per cent sugar sirup in such a way that each 0.01 c c of the dilution would contain an approximate known number of spores, as indicated in Table 2. Sterilized 2 c c Luer tuberculin hypodermic syringes graduated in 0.01 c c, the needles of which had been blunted, were used in inoculating the

TABLE 2—RESULTS OF INOCULATION OF INDIVIDUAL HEALTHY BEE LARVAE WITH KNOWN NUMBERS OF SPORES OF BACILLUS LARVAE, 1930.

Spores fed each larva in 0.01 cubic centimeter of dilution.	First inoculation, July 14.		Second inoculation, Aug. 1.			Third inoculation, Aug. 19.							Fourth inoculation, Aug. 21.							
	Colony No.	Larvae developing disease Aug. 1.	Colony No.	Larvae developing disease.		Colony No.	Length of time isolated from nurse bees.	Effect on larvae of being isolated from nurse bees.	Larvae developing disease.				Colony No.	Length of time isolated from nurse bees.	Effect on larvae of being isolated from nurse bees.	Larvae developing disease.			
				Aug. 19	Oct. 7				Aug. 26	Sept. 9	Sept. 19	Oct. 7				Aug. 26	Sept. 9	Sept. 19	Oct. 7
Number.		*Number.*		*Number.*	*Number.*		*Hours.*		*Number.*	*Number.*	*Number.*	*Number.*		*Minutes.*		*Number.*	*Number.*	*Number.*	*Number.*
50,000,000	------	------	------	------	------	12	1	Larvae removed	0	0	0	0	12	5	Larvae removed	0	0	0	0
25,000,000	------	------	------	------	------	13	1	..do	0	0	0	0	13	10	..do	0	0	0	0
10,000,000	------	------	------	------	------	20	½	Larvae not removed	0	[1]13	------	------	20	15	Larvae not removed	0	[2]9	------	------
7,500,000	------	------	------	------	------	15	1	Three-fourths of larvae removed	0	0	0	0	15	20	..do	0	0	0	0
5,000,000	------	------	14	0	0	4	½	One-half of larvae removed.	0	0	0	0	4	30	One-half of larvae removed.	0	0	0	0
1,000,000	------	------	34	0	0	16	1	Larvae not removed	0	0	0	0	------	------	------	------	------	------	------
500,000	------	------	16	0	0	22	1	..do	0	0	0	0	------	------	------	------	------	------	------
250,000	------	------	18	0	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------
100,000	------	------	22	0	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------
75,000	------	------	26	0	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------
50,000	------	------	28	0	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------
25,000	------	------	4	0	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------
10,000	------	------	15	0	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------
7,500	------	------	20	0	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------
5,000	12	0	12	0	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------
1,000	13	0	13	0	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------
750	14	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
500	15	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
250	18	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
100	22	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
75	26	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
50	28	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
25	4	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
10	15	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
5	20	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
1	34	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
0	32	0	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

[2] Number of cells showing American foul-brood remains.

cells containing coiled larvae. Fifty or more coiled larvae at least 4 days old were each given 0.01 c c of a dilution of spores, each dilution being given to larvae in one comb in a separate colony, and the cells so inoculated were distinctively marked. A few larvae that had just been sealed also were inoculated by puncturing the capping with the inoculating needle and depositing the 0.01 c c in the cell. Observations were taken at the end of 24 hours and at frequent intervals thereafter until the end of the brood-rearing season.

In the first series of inoculations the number of spores fed each larva ranged from approximately 5,000 down to 1. None of the larvae inoculated developed disease. (Table 2.) Later a second series of inoculations was made. The same colonies were used because of the limited number available, but the larvae inoculated were in a different comb in each colony and a different color was used to mark the cells. In these inoculations the number of spores fed ranged from 5,000,000 down to 1,000 per larva. No disease developed from this set of inoculations.

It was thought possible that the nurse bees might be removing most, if not all of the inoculated sugar sirup before the larvae had had time to ingest a sufficient number of spores to bring about infection. Therefore, in a third series of experiments each inoculated comb was placed in a screen-wire queen-nucleus introducing cage, and this cage was put back in the colony for periods ranging from one-half to one hour before the unprotected comb was replaced in the colony, thus theoretically giving the larvae time to ingest some of the sugar sirup before the nurse bees had access to the inoculated cells. In these tests the larvae were kept from the bees so long that many of them, becoming hungry, were starting to crawl from the cells. The number of spores fed ranged from 50,000,000 down to 500,000 per larva. Twenty-four hours after the larvæ were fed it was found that all receiving 50,000,000 and 25,000,000 spores had been removed from the cells, while those receiving a smaller number of spores were either partly removed or remained in the cells, according to the strength of the dilution and the length of time that the larvae were kept away from the nurse bees. (Table 2.)

Two days later another set of larvae was inoculated with the same dilutions as were previously used for these colonies but on the other side of the same combs. In this series the combs were kept away from the bees for periods ranging from 5 minutes for the heaviest dilution to 30 minutes for the weakest. Again all the larvae receiving the 50,000,000 and 25,000,000 spores were removed, while those receiving the 5,000,000, which were kept from the bees for half an hour, were partly removed, and those receiving 7,500,000 or 10,000,000 were not removed. Apparently there are two factors concerned in the removal of the larvae—the length of time they are kept away from the bees and the amount of foreign matter in the sirup, as indicated by the spore content, that is given to the larvae.

The results of the last two series of inoculations showed that in the colonies in which the larvae were not removed, or were not entirely removed, several larvae in the colony receiving 10,000,000 spores per larva developed disease, while those in the colonies receiving a smaller number remained healthy. (Table 2.) This work should be repeated with a

different oclony for each set of inoculations, although apparently the disease did not spread in the colonies used. Only one colony of the entire number developed disease. Although a certain degree of success was obtained, these results seem to bear out Toumanoff's (*29*) conclusion that the artificial infection of individual larvae is not brought about so easily as one had been in the habit of believing. Apparently, also, a considerable number of spores are necessary to establish an infection under these conditions.

Minimum Number of Spores of Bacillus Larvae Producing Vegetable Growth on Artificial Culture Media.

Bacteria are known to pass through a definite cycle of growth, particularly when cells from an old culture are transferred to fresh culture media. The growth stages have been described by Buchanan (*3; 13, Ch. V*), Henrici (*12*), and Winslow (*13, Ch. VI*) somewhat as follows: The initial stationary phase during which no growth takes place; the logarithmic phase when the organisms begin to divide, slowly at first but gradually accelerating; and so on through the complete cycle of growth. Henrici (*12, p. 21, 24*) has observed that—

> Various factors, as temperature; the size, the age, and previous history of the inoculum; and the composition and nutrient value of the medium, influence the growth curves of bacteria. * * * Of the various factors which influence the rate of growth and form of the growth curve, the initial number of cells introduced into a unit volume of medium seems to be one of the most important.

Robertson (*25*), in studies of cultures of certain protozoa, has shown that growth seems to be stimulated by the presence of other cells of the same type. This characteristic has been described at various times as mass action or communal activity.

Early in 1929, in conjunction with the spore-feeding experiments in the apiary, an investigation was started to determine whether there is a similar manifestation of mass action in the vegetative growth of spores of *Bacillus larvae* on artificial culture media. In a preliminary paper on this subject the writer (*27, p. 456*) made the following observations: Starting with a seeding of 5,000,000,000 spores of *B. larvae* on a suitable slanted solid culture medium, it was found at the end of 48 hours' incubation at 37°C. that growth had occurred in the original and in a diluted seeding containing 60,000,000 spores, but not in one containing 50,000,000 spores. Growth occurred in a diluted seeding containing only 5,000,000 spores after six days' incubation, and in one containing 700,000 spores after 10 days' incubation. (Table 4, Group 1.) These observations indicated that a certain initial mass of spores is necessary to start vegetative growth. Furthermore, although the growth results were rather irregular owing to the comparatively small number of cultures made, they seemed to show that, within certain limits, the smaller the seeding the longer the incubation period necessary to obtain germination of the spores and vegetative growth. From this preliminary work it was assumed that the lower limits of dilution of the stock suspension that would give growth on longer incubation had not been reached.

Ahrens (*1*) has observed, in cultural studies of scales treated with formalin solution for different lengths of time, that growth may occur

in cultures from such scales after varying periods of incubation up to 30 days, depending on the length of treatment and the percentage of formalin in the solution. Burnside (7) states, in connection with studies of disinfection of American foulbrood combs by fumigation with formaldehyde gas, that "it is probable that if scales had been washed and the incubation period increased, growth of *Bacillus larvae* would have been obtained in some instances when negative results were recorded."

Therefore, a single trial series of cultures was run (No. 7, Table 4), the total incubation period being 30 days. Results from this set of cultures showed that in some cases growth was obtained after 30 days' incubation where no growth was observed after 10 days' incubation. Work on this phase of the problem was continued during the summer and fall of 1930. Several sets of cultures were made in which *Bacillus larvae* from eight different localities were used in a series of seedings with a decreasing number of spores for each lot of the organism and all incubated for 30 days. (Table 4, Group 2.)

METHODS OF PROCEDURE.

Culture Media.

A culture medium was used similar to that employed by the writer in the preliminary experiments (*27*) and also in earlier cultural work with *Bacillus larvae* (*26*)—that is, a combination of the medium made of yeast-extract and egg-yolk suspension and the carrot-extract medium of Lochhead (*18*). The yeast-carrot extract medium was prepared as follows:

(A)	Dried yeast	grams..	10
	Peptone	do....	10
	Buffer (sodium glycerophosphate)	do....	2. 5
	Water (distilled)	cubic centimeters..	500

This solution was heated in flowing steam for one-half hour and, after a tablespoonful of siliceous earth had been added to assist in the filtration and clarification, it was filtered through filter paper on a perforated porcelain funnel with suction.

(B) Two hundred grams of cleaned carrots was macerated in a meat grinder, added to 500 c c of distilled water, and allowed to stand for at least 30 minutes, preferably longer. The macerated carrot was removed by filtration through fine muslin, as much liquid as possible being squeezed from the mass. The filtrate was then clarified by the addition of siliceous earth and filtration in the same manner as the yeast-extract medium.

(C) The final base medium was prepared by mixing 500 c c of A with 200 c c of B and adding 700 c c of a 3 per cent solution of washed agar.

The reaction of the medium was so adjusted that when 2 c c of sterile egg-yolk suspension, prepared as described in a previous paper (*26*), was added to 10 c c of the yeast-carrot extract base medium by means of the apparatus shown in Figure 1, and described previously (*26*), the pH value was 6.8. The medium was then sterilized in the autoclave at 15 pounds' pressure (sea level) for 15 minutes. After it had cooled to 45°C., 20 drops, or about 2 c c, of the sterile egg-yolk suspension was added to each tube of medium, mixed by shaking, and the medium was then allowed to solidify in a slanting position.

The Lochhead yeast-extract medium was tried without the addition of egg-yolk suspension, but although it gave good growth with the heavier seedings of spores, the combination medium was found to give more uniform germination and heavier vegetative growth with the more dilute

seedings. The addition of the carrot-extract, while possibly adding somewhat to the growth-producing qualities of the medium, served in these experiments as an indicator for vegetative growth because of the ability of *Bacillus larvae* to produce nitrite in the carrot-extract medium without the addition of potassium nitrate (*18*).

Preparation of Dilution of Spores.

The stock suspensions of spores of *Bacillus larvae* were made up as described earlier in this paper. A series of primary dilutions, each one-tenth of the preceding dilution, was then made up in sterile 125 c c flasks by adding 4 c c of a dilution to 36 c c of sterile water. The series of dilutions containing gradually decreasing numbers of spores per cubic centimeter to be used in inoculating the culture medium were then prepared as indicated in Table 4. Sterile burettes were used in adding the proper proportions of spore suspension or spore suspension dilutions to the proper quantities of sterile water in sterile test tubes, in order to make up the desired series of dilutions containing approximately known numbers of spores.

Inoculation of Culture Medium.

Swann has observed that in old cultures of anthrax a considerable percentage of spores are dead and therefore never germinate. Because of the possibility that some of the spores in the stock suspensions of *Bacillus larvae* might not be viable, an effort was made to determine the approximate proportions of viable and dead spores in the stock suspensions. Since the determination of viable spores of *B. larvae* by means of plate cultures is difficult because of the opaqueness of the special culture medium that is required, an attempt was made to determine the percentage of viable spores by the differential staining method of Burke (*4*) as modified by Koser and Mills (*15*). The procedure is as follows: A small quantity of the spore suspension is spread in a thin film on a slide and allowed to dry without heating. The slide, after immersion in a solution of carbol fuchsin at room temperature for two minutes, is washed in water and decolorized with absolute acetone for a few seconds, washed again, and immersed in Loeffler's alkaline methylene blue for two minutes, washed, dried, and examined. Very few solid-staining forms were observed in any of the suspensions examined, possibly one or two spores in several fields. It was therefore assumed that the number of nonviable spores could be considered as negligible and probably within the limits of the precision of the measurements as indicated by this procedure.

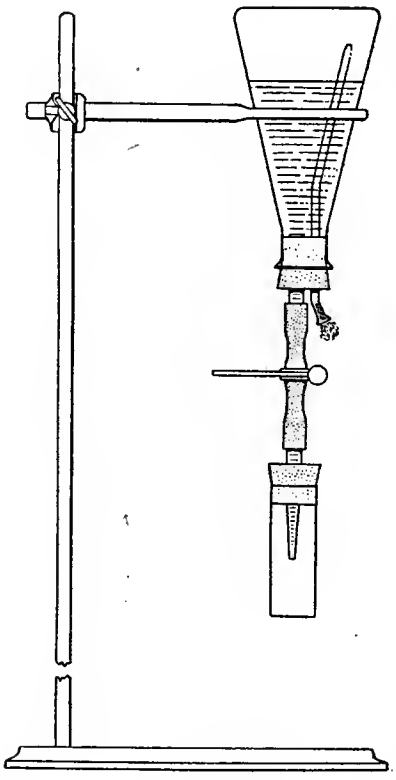

Figure 1—Apparatus to replace pipetting of egg-yolk suspension.

One cubic centimeter of each dilution was added to duplicate tubes of the slanted solid medium by means of sterile 1 c c pipettes, each cubic centimeter of inoculum containing an approximately known number of spores of *Bacillus larvae.* After inoculation the cultures were incubated at 37° C. In order to prevent the liquid in the tubes from drying out on long incubation, from time to time, as the water of condensation evaporated, 2 or 3 c c of sterile broth similar in composition to that of the base medium, without the egg, was added to each tube by means of the apparatus shown in Figure 1. A total of 556 cultures was made during this series of experiments.

METHOD OF MAKING OBSERVATIONS.

The culture tubes were incubated for 30 days at 37° C. Each tube was examined usually every 24 hours during this period. The presence or absence of vegetative growth was noted at each observation, and in cases of slight or doubtful growth the vegetative growth was checked both by microscopic examination of a stained smear and by testing for nitrite production in the culture medium by the sulphanilic acid and alpha-naphthylamine acetate test. After a large number of such observations had been made, it was found that vegetative germination of spores of *Bacillus larvae,* almost too slight to be seen, would give a definite pink color on the addition of the reagents.

Lochhead (*17, p. 14*) states:

> **It was found, however, that ordinary nitrate-reducing species, such as *B. cereus* or *Es. coli*, which are able to form nitrites readily in nitrate media, were unable to produce nitrites in recognizable amount in the peptone-carrot media, though capable of doing so upon the addition of nitrates. *Bacillus larvae* under the same condition readily forms nitrites without the addition of nitrate to the medium.**

Despite this statement, a series of miscellaneous organisms was tested in standard nitrate broth, in carrot-extract broth, and on carrot-extract agar. Several organisms that commonly reduce nitrates and a few that do not were used. (Table 3.) Observations were made at short intervals during the first 24 hours. Most of these organisms gave positive nitrite tests within a few hours after inoculation in all the media used, but in the carrot-extract medium the nitrate had apparently disappeared in most cases after 24 hours' incubation, and in all cases after 48 hours. The same organisms on standard nitrate medium still gave positive tests after 48 hours' incubation. A positive nitrite test was obtained in cultures of *Bacillus larvae* that were incubated for 5 days and in one culture that was incubated for 4 days and then allowed to stand at room temperature for 16 days more before testing. Therefore, it appears probable—at least the results in Table 3 indicate—that in the case of many contaminating organisms having the power to reduce nitrite that might get into the culture tubes inoculated with spores of *B. larvae* the nitrite, if produced by the contaminating organism, would have disappeared after 48 hours' incubation, leaving contamination to be determined by gross appearance of the culture and microscopic examination. Nevertheless, in order to be sure that contaminating growth of any kind was not giving erroneous results with the nitrite test when

TABLE 3—NITRATE REDUCTION BY VARIOUS MISCELLANEOUS ORGANISMS IN STANDARD NITRATE BROTH AND CARROT-EXTRACT MEDIA DURING DIFFERENT PERIODS OF TIME.[2]

Organism.	Standard nitrate broth.					Carrot-extract broth.							Carrot-extract agar.					
	3 hours.	6 hours.	8 hours.	24 hours.	48 hours.	3 hours.	6 hours.	8 hours.	10 hours.	14 hours.	16 hours.	24 hours.	3 hours.	6 hours.	24 hours.	48 hours.	5 days.	20 days.
Escherichia communior	3+	4+	4+	4+	4+	2+	—	—	—	—	—	—	+	+	—	—	-------	-------
Escherichia coli	—	3+	4+	4+	4+	—	+	—	—	—	—	—	+	++	—	—	-------	-------
Eberthella typhi	—	3+	4+	4+	4+	—	—	—	—	—	—	—	+	±	—	—	-------	-------
Alcaligines fecalis	+	3+	4+	±	—	Tr.	2+	2+	+	+	—	—	2+	+	+	—	-------	-------
Aerobacter aerogenes	3+	4+	4+	4+	4+	+	—	—	—	—	—	—	Tr.	Tr.	±	—	-------	-------
Pseudomonas aeruginosa	—	3+	4+	—	—	+	2+	2+	+	±	—	—	+	+	+	—	-------	-------
Serratia marcescens	—	3+	4+	4+	4+	—	+	—	—	—	—	—	Tr.	Tr.	+	—	-------	-------
Staphylococcus albus	—	—	—	—	—	—	—	—	—	—	—	—	±	—	—	—	-------	-------
Bacillus subtilis	-------	-------	-------	—	—	-------	-------	-------	-------	-------	-------	—	-------	-------	—	—	-------	-------
Bacillus mesentericus	-------	-------	-------	—	—	-------	-------	-------	-------	-------	-------	—	-------	-------	—	—	-------	-------
Bacillus larvae	-------	-------	-------	2+	4+	-------	-------	-------	-------	-------	-------	2+	-------	-------	2+	4+	4+	4+

[2] +, 2+, 3+, and 4+ indicate relative degrees of reaction; Tr. indicates trace; — indicated no reaction; ± indicates that the reaction was doubtful.

this was used alone, any suspicious-looking growth in the culture tubes was examined under the microscope before it was tested with the reagents for nitrite production. Even though a positive nitrite test might be observed in some cases, the contaminations were recorded only as such.

OBSERVATIONS AND RESULTS.

In no instance was positive growth obtained in cultures inoculated with less than 50,000 spores, even after 30 days' incubation, and growth with 50,000 spores was obtained from only two of the eight lots of spores used, namely, Nos. 19 and 23. (Table 4.) In the other six strains the minimum number of spores that produced positive growth ranged from 5,000,000 to 70,000.

The length of the incubation period in relation to the decreasing number of spores used varied greatly with the different lots of spores, even with the duplicate inoculations of each lot. Table 5 gives the results of positive cultures obtained in relation to the period of incubation and the dilution of the spores. The coefficient of correlation (*14, p. 179*) for the positive cultures only, in relation to length of incubation and dilution of spores, was found to be 0.3558 ± 0.0440. While this does not show a strong correlation, it indicates that with the smaller numbers of spores there is a tendency for growth to take place with longer periods of incubation. However, when the cases of positive growth were correlated with the dilution and incubation time on the basis of the percentage of positive cultures to negative cultures for each observation period of incubation time, an insignificant negative correlation was obtained. Apparently there is a variable uncontrollable factor present, more obvious when spores are used from different lots of the organism, which makes it impossible to correlate the other factors closely. However, the data summarized in Table 6 indicate that, of the 120 cultures made with seedings of between 5,000,000,000 and 9,000,000 spores per seeding, 98.33 per cent showed growth at the end of 10 days' incubation, while 100 per cent (120 cultures) showed growth after 30 days' incubation. This is 56.87 per cent of the 211 total cultures showing growth after 30 days.

Of the 171 cultures made with seedings between 8,000,000 and 500,000 spores per seeding, 48, or 28.07 per cent, showed growth at the end of 10 days' incubation, while 79, or 46.20 per cent, showed growth afer 30 days' incubation. The latter number is 37.44 per cent of the 211 total cultures showing growth after 30 days' incubation.

Of the 142 cultures made with seedings between 400,000 and 50,000 spores per seeding, only 4, or 2.82 per cent, showed growth at the end of 10 days' incubation, while 12, or 8.45 per cent, showed growth after 30 days' incubation. The latter figure is 5.69 per cent of the 211 cultures showing growth after 30 days' incubation.

Of the 123 cultures made with seedings of 40,000 or fewer spores per seeding, no growth was obtained after 30 days' incubation.

Of the 556 cultures made with all seedings, 30.58 per cent showed growth at the end of 10 days' incubation and 69.42 per cent showed no growth. The 170 positive cultures after 10 days' incubation is 80.57 per cent (not shown in Table 6) of the 211 total positive cultures obtained.

TABLE 4.—VEGETATIVE GROWTH IN CULTURES OF BACILLUS LARVAE WITH VARING DILUTIONS OF A STOCK SUSPENSION.

Method of making dilutions.			Spores per cubic centimeter inoculation (×10³).	Strains of bacillus larvae.[2]													
Primary dilution taken.	Quantity of primary dilution taken.	Water added.		Group 1 (preliminary experiments)						Trial series.	Group 2.							
				No. 1.	No. 4.	No. 5.	No. 6A.	No. 6A2.	No. 6D.	No. 7.	No. 12.	No. 13.	No. 14.	No. 15.	No. 19.	No. 20.	No. 21.	No. 23.
	Cubic centimeters.	*Cubic centimeters.*	*Number.*															
	Original		5,000,000	+2+2	+2+2	+2	+2	+6	+10	+5	+2+2	+2=2	+2+2	+2+2	+2+2	+2+2	+2+1	+2+2
	(A)	0	5,000,000															
	8	2	4,000,000			+2												
A	6	4	3,000,000			+2												
	4	6	2,000,000			+2												
	2	8	1,000,000			+2												
	1 (B)	9	500,000	+2+2	+2+2	+2	+2	+6	+10	+5	+2+2	+2+2	+2+2	+2+2	+2+2	+2+2	+2+2	+2+2
	8	2	400,000		+2	+2	+2											
	6	4	300,000		+2	+2	+2											
	4	6	200,000		+2	+2	+2											
B	2	8	100,000		±2?	+2	±2											
(1A+9H₂O)	1.8	8.2	90,000			+2	+2											
	1.6	8.4	80,000			+2	+6											
	1.4	8.6	70,000			−2	+6											
	1.2	8.8	60,000			−2	+2											
	1.0 (C)	9.0	50,000	±2±2	±2?−2	−2	−6	+6	+10	+5+30	+3+3	+3+3	+3+3	+2+2	+2+2	+4+4	+5+5	+4+4
	8	2	40,000			−2	−6	−6	+10	+10+10	+3+3	+3+5	+4+4	+2+2	+2+2	+4+4	+5+5	+4+4
	6	4	30,000			−2	+6	−6	+10	+10+15	+3+3	+5+5	+4+4	+2+2	+3+3	+4+6	+5+5	+4+4
	4	6	20,000			−2	−6	+6	+10	+10+30	+3+3	+5+5	+4+4	+3+3	+3+3	+4+6	+7+7	+4+4
C	2	8	10,000			−2	−6	+6	+10	−30−30	+7+8	+5+7	+6×	+3+3	+6×	+6+6	+7+14	+4+4
(1B+9H₂O)	1.8	8.2	9,000			−2	+6	+6	−10	−10+30				+4+4	+6+6	+6+6	+9+27	+4+4
	1.6	8.4	8,000			−2	−6	+6	+10	−30−30				+4+4	+6+16	+6+11	−27−30	+4+4
	1.4	8.6	7,000			−2	−6	+6	−10	+10−10				+4+4	−30−30	+6+6	−30−30	+4×
	1.2	8.8	6,000			−2	−6	−6	+10	−30−50				+5+6	+6−30	+6+6	+7−30	+4+4
	1.0 (D)	9.0	5,000	−2−2	−2−2	−2	−6	+6	+10	−10+30	+7−30	+14−30	+12−30	+6×	−30−30	+11+14	−30−30	+4+4
	8	2	4,000						+10	−10−30	+7+12	× ×	+6+10	−30×	+8−30	−30×	+17−30	+4+4
	6	4	3,000						+10	−10+30	+6+14	+7×	+10+10	−30−30	+8×	+6+12	+27+27	+6×
	4	6	2,000						−10	−10+30	+6−30	+17−30	+20−30	−30−30	+8−30	+27−30	−30−30	+6+6
D	2	8	1,000						−10	−10−30	+10+14	+21×	−30−30	−30−30	−30−30	−50−30	−30−30	+6×
(1C+9H₂O)	1.8	8.2	900						−10	−10+30	+6×	−30×	+10+16	−30−30	−30−30	+25−30	−30−30	−30−30
	1.6	8.4	800						−10	−10+30	+14+22	+21−30	−30×	−30−30	−30−30	+20−30	+27−30	−30−30
	1.4	8.6	700						+10	−10−30	−30−30	+30×	−30×	−30−30	+8+10	+30−30	+27−30	+8×
	1.2	8.8	600						−10	−10+30	+27−27	−30−30	−30×	−30−30	+13−30	−30−30	−30−30	+6−30
	1.0 (E)	9.0	500	−2−2	−2−2	−2	−6	−6	−10	−10−30	−30−30	−30−30	−30×	−30−30	−30−30	−30−30	+27+27	−30−30

| | | |

TABLE 5—SUMMARY OF THE POSITIVE VEGETATIVE CULTURES OF BACILLUS LARVAE IN RELATION TO LENGTH OF INCUBATION PERIOD AND WITH VARYING DILUTIONS OF THE STOCK SUSPENSION.

Number of spores per cubic centimeter inoculated.	Number of positive cultures after days of incubation.																													Number of cultures.		
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Positive.	Negative.	Total.
5,000,000,000	16																													16	0	16
500,000,000	16																													16	0	16
50,000,000	4	6	4	2																										16	0	16
40,000,000	4	3	6	3																										16	0	16
30,000,000	2	4	5	4	1																									16	0	16
20,000,000		6	5	2	1	2																								16	0	16
10,000,000		2	2	1	4	3	1						1																	14	0	14
9,000,000			4		4			1																		1				10	0	10
8,000,000			4		2					1					1															8	2	10
7,000,000			3		2																									5	4	9
6,000,000			2	1	4	1																								8	2	10
5,000,000			2		1	1				1	1		2																	8	7	15
4,000,000			2		1	1	1		1		1					1														8	4	12
3,000,000					3	1	1		2		1		1													2				11	2	13
2,000,000					3		1									1			1							1				7	9	16
1,000,000					1				1				1							1										4	10	14
900,000					1				1						1									1						4	10	14
800,000													1						1	1	1					1				5	10	15
700,000							2		1																	1			2	6	7	13
600,000					1							1														1				3	12	15
500,000																										2				2	13	15
400,000																														0	15	15
300,000																										1				1	15	16
200,000													1																	1	15	16
100,000																													1	1	15	16
90,000							1																							1	15	16
80,000							1																						1	2	14	16
70,000					1																					2				3	12	15
60,000							1																							1	15	16
50,000										1		1																		2	14	16
0–40,000																														0	123	123
Total positive cultures	42	21	39	13	30	9	9	1	6	3	3	2	7	0	2	2	0	0	2	2	1	0	0	1	0	12	0	0	4	211		
Total negative cultures	514	493	454	441	411	402	393	392	386	383	380	378	371	371	369	367	367	367	365	363	362	362	362	361	361	349	349	349	345		345	
Total cultures																																556

TABLE 6—SUMMARY OF POSITIVE VEGETATIVE CULTURES OF BACILLUS LARVAE GROUPED IN RELATION TO SIZE OF SEEDINGS AND LENGTH OF INCUBATION PERIOD.

Number of spores per seeding.	10 days' incubation.				11 to 30 days' incubation.				Final observations after 30 days' incubation.								
	Number of positive cultures.	Number of negative cultures.	Percentage positive.	Percentage negative.	Number of positive cultures.	Number of negative cultures.	Percentage positive.	Percentage negative.	Total number of positive cultures.	Total number of negative cultures.	Total number of all cultures.	Percentage positive.	Percentage negative.	Percentage positive of total of all positive cultures.	Percentage negative of total of all negative cultures.	Percentage positive of total of all cultures.	Percentage negative of total of all cultures.
5,000,000,000–9,000,000	118	2	98.33	1.66	2	0	1.67	0	120	0	120	100	0	56.87	0	21.58	0
8,000,000–500,000	48	123	28.07	71.93	31	92	18.12	53.80	79	92	171	46.20	53.80	37.44	26.66	14.21	16.55
400,000–50,000	4	138	2.82	97.18	8	130	5.63	91.55	12	130	142	8.45	91.55	5.69	37.68	2.16	23.38
40,000–0	0	123	0	100	0	123	0	100	0	123	123	0	100	0	35.65	0	22.12
Total	170	386	30.58	69.42	41	345	7.37	62.05	211	345	556					37.95	62.05

In the interval between the 10 and 30 day incubation periods, 19.43 per cent (not shown in Table 6) of the 211 total positive cultures, or another 7.37 per cent of all cultures made, showed growth, making a total of only 37.95 per cent of all cultures which showed growth at the end of 30 days' incubation, with 62.05 per cent still showing no growth.

The initial growth phases as described by Buchanan *(3; 13, Ch. V)* are clearly more marked with spores than with simple vegetative organisms, since there is a varying length of time necessary for spores to germinate and start growing after implantation in a suitable medium. In the light of observations on other spore-forming organisms, it is probable that this factor, which seems to cause variations in the germination time of *Bacillus larvae* even within a lot from a single source, is what has been termed "dormancy." Burke *(5, p. 283)*, working with *Clostridium botulinum*, found:

The individual (unheated) spores in a given culture of *Cl. botulinum* vary greatly in the time required for germination under optimum growth conditions. The majority germinate relatively quickly, but a few lie dormant for a longer time. One hundred and forty-four days is the maximum period of dormancy recorded here * * *.

Burke states:

The primary factors which cause the spore to lie dormant for long periods of time under optimum growth conditions are believed to be inherent in the spore itself. It is thought that relative permeability of the spore wall is one of the factors. Environmental conditions may secondarily modify the period of dormancy.

Burke, Sprague, and Barnes *(6, p. 560)* observed the same phenomenon with such non spore-bearing bacteria as *Bacillus coli (=Escherichia coli)*. They found that spores of *B. subtilis* remained dormant 39 days and those of *B. megatherium* 90 days, although a large majority developed in 4 or 5 days. They believe:

Dormancy must be considered a factor in infection. It reduces the chances of infection by reducing the number of organisms that would otherwise start to grow at one time. Since the cells begin to multiply at different times, the body has an opportunity to initiate defensive reactions before all the cells develop. If dormant for a sufficient period, the organisms will be excluded from the body before development takes place.

Swann *(28)* has observed that there is a variation in the germination time of anthrax spores, depending on the age and condition of the spores.

Morrison and Rettger *(24, p. 339)* recently stated—

Because of the marked variability of germination, depending upon the stimuli supplied in the environment, the deduction is made that bacterial spores in the process of germination are vitally active bodies having requirements for metabolic function which are the same as or more exacting and specific than those of the vegetative cells.

Experimental evidence is presented to show that the dormancy of aerobic bacterial spores is largely, if not entirely, determined by conditions in the environment of the spores, and that these factors must be taken into consideration, perhaps specifically for each species, before so-called "inherent" or "normal" dormancy of bacterial spores can be established.

This phase of the work with *Bacillus larvae* is being repeated with the organism obtained from a single source in an effort to determine the importance of this variable factor of dormancy.

Spores of Bacillus Larvae in Commercial Honey.

A few instances have been reported in the bee journals, such as that by Merrill *(22)*, in which American foulbrood has developed as a result of bees having access to cans of infected honey that have been carelessly thrown out. Without doubt in some cases honey has been allowed to get on the market from infected colonies through negligence of the beekeepers and without being diluted by mixing or blending with honey from disease-free apiaries. On the other hand, Fracker (*10, p. 379-380*) has shown, by a study of disease-inspection statistics for Wisconsin:

1. In Wisconsin the introduction of this disease into the State and into many individual localities is definitely known to have been in specific importations of bees and equipment.
2. Cases of infection in which the source appears to be infected honey in the channels of trade are comparatively rare.
3. Even near such a large center as Milwaukee the infection percentage is greatest in localities of active movement, such as greenhouse areas, and is relatively low within the city itself.
4. Towns and cities of from 3,000 to 40,000 which have been natural markets for infected honey from near-by counties, have remained for years free from disease either until the present or until infected bees and equipment were introduced.
5. No new centers of infection are known to have been started since the policy of limiting movement of bees and equipment was begun in 1919.
6. These observations appear to be confirmed by conditions in the South, in spite of the fact that the period of active flight of the bee tends to continue through the peak of honey distribution.

Furthermore, F. L. Thomas, State entomologist of Texas, in an unpublished manuscript states:

The largest of the estimates with reference to the quantity of honey that is brought into Texas in a year is 19 carloads. Most of this honey is produced in California, Colorado, New Mexico, Utah, and Wyoming. * * *

If 19 carloads of foulbrood-infected honey are distributed annually in this State, it seems reasonable to suppose that our inspectors would have a hard time to keep this disease within bounds. In fact, I would expect to find that the inspectors would be gradually losing ground in their attempts to eradicate this menace. A large share of the honey which is imported is sold in west and northwest Texas where practically no bees are kept. The amount which is distributed in the beekeeping territory of the State is evidently less dangerous than is commonly supposed. The following facts, I think, will prove this statement.

During the period September 1, 1920, to August 31, 1926, the inspection work has been carried into 100 counties. Fifty-six counties were found to be free from contagious or infectious diseases of bees, but in the other 44 counties American foulbrood has been present.

An average of 668 beekeepers have been visited each year and 38,661 colonies examined with the result that an average of 430 colonies, or 1.11 per cent, have been found to be diseased.

American foulbrood is found now in only 23 counties, 21 of the 44 counties having been cleaned up. In 12 of the counties where disease occurs, only 30 colonies were found to be infected out of 7,642 examined—less than 0.4 of 1 per cent. Six counties had one diseased colony each.

About 40 per cent of the beekeepers and 60 per cent of the colonies are reinspected from year to year; the remainder, being free of disease and considered out of danger, are dropped and "new territory" is taken over and examined for presence of foulbrood. By "new territory" is meant beekeepers and their colonies visited and inspected for the first time. An average of 228 diseased colonies are discovered each year in "new territory." This is 1.6 per cent of the total number of colonies examined in this territory.

The reinspection which has been made in the counties where disease has been present shows that there have been both gains and losses. But a net gain has resulted which has averaged 21 beekeepers and 368 colonies freed from American foulbrood and quarantine annually.

From these facts it is easily seen that definite and really rapid progress in eradicating the disease is being made. Rarely do our inspectors find new outbreaks of disease that can not be traced to careless beekeeping methods, bees robbing infected and weakened colonies, or to the use of old and infected equipment.

It is not my intention to imply that honey is not a carrier of American foulbrood. The above evidence simply indicates that the honey which has been imported into Texas has not been as dangerous a source of disease to bees as is sometimes thought.

Practically no work has been reported on the microbiology of honey other than that in connection with the spoilage of honey through fermentation by yeasts (*19, 21*), and no work appears to have been done on the *Bacillus larvae* spore content of commercial honey. In 1925 the writer undertook to devise a method for demonstrating, at least qualitatively, the presence or absence of spores of *B. larvae* in honey and their significance in relation to the results of the spore-feeding experiments. Difficulties were encountered in obtaining cultures of *B. larvae* from honey. It was impossible to obtain vegetative growth of this organism, even when a considerable number of spores had previously been added to honey, because of the difficulty of eliminating contaminating organisms that developed rapidly in the honey, completely overgrowing any possible vegetative growth of *B. larvae* before it could get well started. Therefore, methods of concentrating the spores from the honey and of identifying them by means of microscopic examination were attempted. Because spores of *B. larvae* have a characteristic appearance in stained smears (*20, p. 9*), it was assumed that this method might give at least tentative evidence.

METHODS OF PROCEDURE.

The first method attempted was the filtration of honey diluted with water through a membrane of ether-alcohol collodion or through filter paper impregnated with an acetic acid solution of collodion (*9*). Apparatus was devised in which both suction and pressure were tried in this filtering process. Stained smears were made of the sediment retained on the surface of the filter. In several cases spores of *Bacillus larvae* were observed in stained smears of the sediment filtered out of honey known to have a large spore content. However, with honey containing fewer spores it was found impossible to concentrate them on a small enough area of filter in sufficient numbers to recover and identify them under the microscope. Even with a comparatively large filtering sur-

face, the process was so slow that the diluted honey would frequently start to ferment before it had all passed through the filter. A filter of smaller area would become clogged, preventing the passage of a sufficient quantity of honey.

Several unsuccessful attempts were made to recover spores of *Bacillus larvae* from honey by centrifuging samples diluted with an equal quantity of water. After considerable experimentation with honey of known spore content, it was found that it was necessary to dilute the honey to a much greater extent—1 part to at least 9 of water—in order to throw the spores down with the sediment. Apparently the specific gravity of these spores is so low that on centrifuging they remain in suspension in only slightly diluted honey.

The procedure finally used for demonstrating the presence of spores of *Bacillus larvae* in honey is as follows: Five c c of warmed honey is thoroughly mixed with 45 c c of distilled water in a 50 c c cone-shaped centrifuge tube made of heat-resistant glass. Duplicate quantities of each sample of honey are made up for examination. The diluted honey is then centrifuged at 2,000 revolutions per minute for one-half hour. Because of the difficulty of obtaining a satisfactory stained smear from the sediment thrown down in the presence of the sugars of the honey solution, all but 2 c c of the solution in each centrifuge tube is drawn off by means of a 50 c c pipette. Another 45 c c of distilled water is added, the sediment is thoroughly shaken up in the water, and the tubes are centrifuged again for 20 minutes. After all but 2 c c or less of the wash water has been removed, 0.01 c c of the sediment is removed by means of a capillary pipette and smeared on a cover glass over a surface of 1 cm^2, a small loopful of carbol fuchsin being mixed with the material before it is allowed to dry. After drying by gentle heat, the cover glass is mounted on a slide by means of a drop of distilled water and the smear is examined with an oil-immersion objective. Spores of *B. larvae* are identified by their size and shape in conjunction with their distinctive habit of breaking loose from the stained mass of the smear and of showing a delicate Brownian movement in the thin film of water between the two pieces of glass. In a few samples only one or two spores were seen in numerous fields examined or the spores did not have the typical appearance of spores of *B. larvae*. In such cases another test, in which twice as much honey was used, was made from the sample.

OBSERVATIONS.

One hundred and ninety-one samples of honey were examined by this method. (Table 7.) Of these, 187 were regular commercial samples purchased in the open market and 2 were from the experimental apiary at Laramie. The other two were miscellaneous samples, one of which was obtained from a brood comb from a diseased colony and the other from a cappings melter which had been used with combs from an infected apiary.

TABLE 7—RESULTS OF THE EXAMINATION OF SAMPLES OF HONEY FOR THE PRESENCE OF SPORES OF BACILLUS LARVAE.

Source.	Samples tested.	Samples showing positive presence of spores resembling *Bacillus larvae*.	Samples showing no evidence of spores.[2]
Commercial samples from 30 states	187	15	172
Experimental	2		2
Miscellaneous	2	2	
Total	191	17	174

[2] 29 of these samples were doubtful on the first examination, but repeated examinations gave negative results in each case.

Of the 187 samples of commercial honey obtained from 30 different States or Territories, 15, or 8 per cent, showed the presence of a sufficient number of spores resembling spores of *Bacillus larvae* to be designated as positive. In 29 of the commercial samples, or 15.5 per cent, one or two doubtful spores were seen in each case, but on repeated examinations none of these samples could be considered positive. Two of the four miscellaneous samples from infected sources were also found to contain spores of *B. larvae*.

Five of the samples showing the presence of spores of *Bacillus larvae* were led to healthy 5-frame colonies during the summer of 1930. These samples consisted of from a pint to a quart of honey. No evidence of American foulbrood appeared in any of the five colonies during the entire brood-rearing season.

In order to determine the approximate number of spores in the samples of honey in which the presence of *Bacillus larvae* was demonstrated, a series of dilutions of spores was prepared as described for the work with cultures. A stained smear was made of 0.01 c c of each dilution spread over a 1-cm^2 surface of cover glass mounted with water and examined with the oil-immersion objective. By this means a definitely recognizable number of spores could be found down to the dilution of 2,000,000 spores per cubic centimeter, with a few single spores seen in occasional fields down to the dilution of 500,000 spores per cubic centimeter. (Table 8.) Then 1 c c of each dilution was added to 5 c c distilled water in 15 c c centrifuge tubes and centrifuged at 2,000 revolutions per minute for 20 minutes. A stained smear made from 0.01 c c of each sediment showed a definitely recognizable number of spores down to the 5,000-spore dilution, with one or two doubtful spores in several fields from the 500-spore dilution. The sample containing the 50,000-spore dilution, which would be comparable to the sugar sirup containing the minimum number of spores per cubic centimeter fed to colonies in the spore-feeding experiments that produced infection, showed a great many more spores in each field examined by this method than did the sample of commercial honey that showed the greatest

number of spores. Therefore, until a better quantitative method is devised, it seems reasonable to believe, from the indications of the preliminary work on this problem, that, even though the presence of a few spores of *B. larvae* may be demonstrated in 5 c c quantities from a comparatively small percentage of samples of commercial honey, the numbers are far below the minimum necessary to produce infection when such honey is used in healthy colonies of bees. Before definite conclusions can be drawn, it will be desirable to examine many more samples of commercial honey and to feed to healthy colonies samples of honey in which the presence of spores has been demonstrated.

TABLE 8—MICROSCOPIC EXAMINATION OF DILUTIONS FOR SPORES OF BACILLUS LARVAE.[2]

Number of spores per cubic centimeter in each dilution.	Direct examination of 0.01 cubic centimeter.	Examination of sediment after centrifuging 1 cubic centimeter.	Number of spores per cubic centimeter in each dilution.	Direct examination of 0.01 cubic centimeter.	Examination of sediment after centrifuging 1 cubic centimeter.	Number of spores per cubic centimeter in each dilution.	Direct examination of 0.01 cubic centimeter.	Examination of sediment after centrifuging 1 cubic centimeter.
5,000,000,000	+	+	10,000,000	+	+	100,000	—	+
4,000,000,000	+	+	9,000,000	+	+	90,000	----	+
3,000,000,000	+	+	8,000,000	+	+	80,000	----	+
2,000,000,000	+	+	7,000,000	+	+	70,000	----	+
1,000,000,000	+	+	6,000,000	+	+	60,000	----	+
500,000,000	+	+	5,000,000	+	+	50,000	—	+
400,000,000	+	+	4,000,000	+	+	40,000	----	+
300,000,000	+	+	3,000,000	+	+	30,000	----	+
200,000,000	+	+	2,000,000	+	+	20,000	----	+
100,000,000	+	+	1,000,000	±?	+	10,000	----	+
90,000,000	+	+	900,000	----	+	5,000	—	+
80,000,000	+	+	800,000	----	+	4,000	----	----
70,000,000	+	+	700,000	----	+	3,000	----	----
60,000,000	+	+	600,000	----	+	2,000	----	----
50,000,000	+	+	500,000	±?	+	1,000	----	----
40,000,000	+	+	400,000	—	+	500	—	±
30,000,000	+	+	300,000	—	+	50	—	—?
20,000,000	+	+	200,000	—	+	5	—	—

[2] + indicates that spores were found; — indicates that spores were not found; by microscopic examination; ± indicates that the result was doubtful; ±? indicates that the positive was more doubtful than the negative; —? indicates that the absence of spores was not definite.

Summary and Conclusions.

As a result of five years' study it has been found that, in order to produce American foulbrood infection in a healthy colony of bees, the sugar sirup used for inoculation must contain a certain initial number of spores of *Bacillus larvae.* Seventy-three colonies were inoculated during this time with numbers of spores ranging from approximately 5,000,000,000 to 100,000 per colony; 30 of these colonies receiving 50,000,000 spores or less. Of these 30 colonies, 2 out of 11 receiving 50,000,000 spores showed infection, but no colony receiving less than that number of spores developed disease. Therefore, the minimum infectious dose of *B. larvae* for a colony of bees seems to be approximately 50,000,000 spores in 1 liter of sugar sirup.

Preliminary experiments in which individual bee larvae were given known numbers of spores of *Bacillus larvae* in 0.01 c c quantities of sugar sirup show that infection can be produced by this method, but with considerable difficulty. From 50 to 100 larvae were inoculated with each dilution of spores, ranging in number from approximately 50,000,000 spores to, theoretically, 1 spore per larva. The minimum infectious dose was found to be 10,000,000 spores per larva fed in 0.01 c c of sugar sirup. These results indicate that the minimum dose of spores of *B. larvae* that will produce American foulbrood infection must be large.

The germination of spores of *Bacillus larvae* and vegetative growth on a suitable artificial culture medium resulting from the inoculation of 556 culture tubes with seedings varying from approximately 50,000,000,000 to 500 spores per culture also shows that a certain minimum initial number of spores in the inoculum is necessary in order to produce growth. This minimum number of spores producing vegetative growth on a medium consisting of yeast-carrot extract, egg-yolk suspension, and agar was found to be approximately 50,000 in 1 c c of suspension inoculated.

The production of nitrite in this medium by the vegetative growth of *Bacillus larvae* serves as a fairly delicate and reliable indicator of such growth.

There was a tendency for the seedings containing the smaller numbers of spores of *Bacillus larvae* to require a longer period of incubation than the larger seedings in order to produce vegetative growth. However, there was a considerable variation in the germination time of many of the seedings of spores, in one case a seeding of 9,000,000 spores requiring 27 days' incubation to produce growth and another of 70,000 spores requiring only 6 days. This variation, thought to be due to the variable character known as dormancy in bacterial spores, prevented more than a slight correlation.

In the group of cultures comprising seedings between 5,000,000,000 and 9,000,000 spores, only 1.67 per cent required more than 10 days' incubation to produce vegetative growth, 100 per cent having shown growth after 30 days. In the group of cultures comprising seedings between 8,000,000 and 500,000 spores, 71.93 per cent required more than 10 days' incubation, while 53.81 per cent showed no growth at the end of 30 days' incubation. In the group of cultures comprising seedings between 400,000 and 50,000 spores, 97.18 per cent required more than 10 days' incubation, while 91.55 per cent of the group showed no growth at the end of 30 days. Below 50,000 spores no growth was obtained. In other words, below a seeding of 9,000,000 spores an increasing number of the smaller spore seedings required a longer period of incubation. About 80 per cent of all the positive cultures were obtained during the first 10 days of incubation, although this was approximately only 30 per cent of all the cultures made; at the end of 30 days' incubation only about 38 per cent of all the cultures had shown any growth.

It was found possible to demonstrate the presence of spores of *Bacillus larvae* in 15 out of 187, or in 8 per cent, of the samples of commercial honey examined by means of the centrifuge and the microscope. The preliminary results indicate that, even though spores of *B. larvae* may be demonstrated in a certain percentage of samples of commercial honey, in most instances they are probably present in such small numbers as to be less than the minimum number, 50,000,000 per liter, found to be capable of producing disease, and therefore are ineffective in the spread of American foulbrood.

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COUNTY ASSOCIATION ACTIVITIES FOR 1932.

Champaign County Association.
(V. G. Milum, Champaign, Secretary.)

The 1932 activities of the Champaign County Beekeepers' Association consisted of an outdoor meeting at Homer Park near Homer on July 15, and an evening meeting at Champaign on December 16.

For the meeting of July 15, the beekeepers of Vermilion County were invited which resulted in an attendance of approximately fifty. Mr. A. L. Kildow of Putnam, chief apiary inspector, discussed bee diseases and their eradication. Other speakers were Mr. M. E. Smith, Mahomet; Palmer Davis, Homer; and V. G. Milum, Champaign.

The meeting of December 16 was held at the beekeeping classroom at the University and a good portion of the evening was spent in examining and discussing the bee equipment on display, after which the election of officers resulted in the reelection of Mr. W. H. Force of Champiagn as President; Rev. E. J. Reese, Urbana as Vice-President; and V. G. Milum of Champaign as Secretary-Treasurer.

The organization went on record favoring the continuation of the appropriation for bee inspection work with Mr. W. H. Force, our president, receiving the endorsement for local inspector. Since this meeting petitions have been circulated among the beekeepers to which one hundred sixteen names have been signed favoring the retention of Mr. Force as local inspector. As this list represents practically all of the larger beekeepers, both Democrats and Republicans, it bespeaks well for the work of Mr. Force as inspector during the last seven years. All are hoping that the inspection work may be continued.

Cook-DuPage County Association.
(E. J. McCormick, Chicago, Secretary.)

President—Mr. C. L. Duax.
First Vice-President—Mr. A. D. Boal.
Second Vice-President—Mr. Leroy Stockdale.
Third Vice-President—Mr. M. Guthrie.
Fourth Vice-President—Mr. Adam Bodenschatz.
Fifth Vice-President—Mr. Wm. Bigel.
Secretary and Treasurer—Mr. E. J. McCormick.

The twelfth annual business meeting of the Cook-DuPage Beekeepers' Association was held Monday evening, February 15, 1932, in Parlor "F" of the New Bismarck Hotel, and the above officers were elected to officiate for the year of 1932.

The speaker of the evening being Mr. Kennith Hawkins, of Watertown, Wisconsin, whose message to us was very instructive. I believe, Mr. Hawkins, that the majority of our members agree with your idea of clipping off the head of non-producing Queens and supersede her with a young laying Queen or unite the colony.

A motion was made by Mr. A. D. Boal that the association money lost by the treasurer in the West Englewood Trust and Savings Bank be paid back to him by our association out of the receipts as soon as possible. Motion was carried.

We also enjoyed an entertainment which was furnished by our home talent. Miss Clarice Parkhurst favored us with a piano solo and as the accompanist for our other talent. Mr. C. L. Duax brought spring just a little nearer to us with his bird whistling solos. Mr. R. C. Bryant brought out the musical possibilities of a saxophone in his solos in such a way that many of us have altered our opinions about saxophone players. A short reading was given by Mrs. R. C. Bryant. The program closed with a vocal solo by Mr. E. J. McCormick.

We intend to hold our next meeting in March, at which time package bees and spring management will be fully discussed.

It was voted at this meeting that Mr. Samuel Cushman, Mr. J. R. Wooldridge and Mr. C. F. Kannenberg's names be placed on the honorary membership list.

The first outdoor meeting for the year 1932 was held Saturday afternoon, May 21st at the apiary of Wm. Wallanches, located three miles out of Downers Grove, Illinois.

In spite of the rather cool and windy day, we had an attendance of approximately fifty, and had an interesting time discussing the problems of our local conditions and making plans for the coming year.

The Cook-DuPage "Tested Recipes" leaflet idea was suggested at this meeting by Mrs. C. L. Duax, and the ladies of our association were requested to submit a tried honey recipe for this leaflet.

Refreshments were served in the home of Mr. Wallanches as it was too cool to serve out-doors.

Our second outdoor meeting was held Saturday afternoon, July 9th, at the apiary of Mr. W. H. Howard located at Worth, Illinois, with approximately sixty-five in attendance, who represented about 1,100 colonies of bees.

The speaker at this meeting was our State Bee Inspector, Mr. A. L. Kildow. He presented some interesting ideas on control of American foulbrood; and some statistics.

The ladies of our association prepared a honey table on which was various food items prepared with honey as one of the ingredients along with the recipe for making each item. We know that the ladies of our association are using honey in the home as this display was proof of it.

As honey is now being sold at a number of prices, this was discussed at this meeting and it was suggested that the 5-pound pail be sold for $0.75 on the road stands and $0.85 if delivered to the home.

A light lunch has been served at our outdoor meetings which has been enjoyed by all; each member bringing the item requested of him to help make up the luncheon.

The August outdoor meeting was held Saturday, August 27th, at the Techny Apiary located at Techny, Illinois.

Our host, Brother Frederick, had a pleasant surprise for those in attendance with his modern apiary equipment and methods of management; also by his contribution to our honey table which consisted of honey rolls, honey cake, honey jelly and honey iced tea.

The speaker of the meeting, Mr. H. H. Root, presented some interesting facts relative to substitution of beeswax by the electric manufacturing and candle manufacturing industries; and we all know the results by the low prices we are offered for our beeswax.

It was also passed at this meeting that we have a medium of barter and exchange for our members through the secretary.

The last outdoor meeting of the year was held Saturday afternoon, October 1st, at the apiary of Mr. C. F. Rife at Naperville, Illinois, with an attendance of approximately one hundred.

Cooperation among the beekeepers in the sale of honey was urged relative to grading of honey, uniformity in containers used, and maintaining a recommended resale price.

The honey table conducted by the women of our association throughout the summer meetings has resulted in a "Tested Recipes" leaflet which is to be given to the trade. In addition to the association name being on this leaflet, the name and address of member is also shown. The cost to each member for these leaflets being $1.35 for 375 copies, and can only be purchased by association members.

Our membership for the year 1932, includes forty-three members and four associate members.

DeKalb County Association.

(C. H. Tudor, Sycamore, Secretary.)

Our association held its annual meeting at DeKalb in December, 1932.

Officers elected for 1932 and 1933 are as follows: President, L. A. Dean, Big Rock; Vice-President, H. Schultz, Waterman; Secretary and Treasurer, C. H. Tudor, Sycamore.

We held two field meetings in 1932; one at Mr. Dean's in the spring, and one at my place in the fall with 60 in attendance. The ladies gave a cooking demonstration using honey. Speakers of the day were Everett Warren and William Ritter. Pot luck dinner with ice cream and coffee was served.

We donated 17 cases of comb honey to the American Honey Institute. A straw vote on the election was taken with the Democrats winning.

Hancock County Association.

(M. G. Dadant, Hamilton, Secretary.)

The honey crop during the past three years in Hancock County has been extremely small and as a consequence, the County Beekeepers' Association has suffered in numbers although we are still active. No meetings were held.

The crop for the 1933 season promises to be considerably better and we anticipate being able to revive the association and send in a bigger membership list for next year.

Henry County Association.
(Elmer Kommer, Woodhull, Secretary.)

At our annual meeting held on October 6, 1932, the following officers were elected for the year:

Willis Drehmer, Osco, President; Ed. Kommer, Andover, Vice-President; Elmer Kommer, Woodhull, Secretary; P. A. Carlson, Galva, Treasurer; Directors: Lawrence Peterson, Kewanee; Axel A. Peterson, Cambridge; Albert Knack, Geneseo.

The speakers at our annual meeting were Mr. A. L. Kildow, chief inspector of apiaries, and Edwin Peterson, Kewanee, Illinois, who spoke on the uses of honey in canning fruit.

Mr. Peterson has made some experiments in canning fruit, using honey as sweetening, and has been very successful in all experiments.

Mr. Kildow's talk was on Disease of Bees, and his method of eradicating same; he also urged the association to ask for the present appropriation as it was needed to carry out the inspection work as it should be done.

Henry County has no fair this year, so no honey show as usual. But two of our members showed at the State Fair and were rewarded well for their efforts. Those showing were Lawrence Peterson, Kewanee, and Ed. Kommer, Andover.

During the year we lost two of our members by death, Mr. W. L. Myers, Geneseo, and Dan McKillop, Lynn Center, both practically charter members of our association who have contributed annually to this association. Mr. Myers was one of our officers at the time of his death.

No field meeting was held this year as it was impossible to secure outside speakers for such a meeting, and then the flow was so short with prices low, that the beekeepers lost interest.

Our crop in this county ranged from 25 per cent to 50 per cent of a crop this year with better prospects ahead for 1933, as we had enough moisture to start the white clover plants, which looked very good when the ground froze up last fall.

Even with a short crop this year, the honey is moving very slow at unsatisfactory prices compared with the prices we have to pay for supplies.

McHenry-Lake County Association.
(C. P. Jankowski, Gurnee, Secretary.)

This association held three meetings during the year 1932.

The annual meeting was held at Cary, on May 5th with the election of officers as follows:

President, H. W. Jones; Vice-President, W. L. Ritter; Secretary, and Treasurer, C. P. Jankowski.

Mr. A. L. Kildow gave a short talk on the "Control of American Foulbrood."

Mr. W. L. Ritter also gave a very interesting talk on "Spring Management of Bees."

The second meeting was held on June 25th at Mr. F. H. Miller's residence at Wilson, Illinois.

Mr. H. F. Wilson from the University of Wisconsin gave a very instructive talk on "How to Market Honey."

The last meeting was held at the city hall in Mundelein, Illinois, on September 17th. A good attendance was shown at this meeting by the beekeepers. Everyone seemed to be more than pleased with the moving pictures that were shown. They were entitled, "The Realm of the Honey Bee." After the movies, cake and ice cream were served by the beekeepers' wives. The meeting was adjourned at 5:45 p. m.

The reason for the decrease in membership this year is just like a lot of the larger industries, the depression struck it.

McLean County Association.

(Glenn L. Hargitt, Danvers, Secretary.)

Our association held a field meeting at the home of Mr. Wolcott in Normal, Illinois. We had an interesting meeting with about twenty-five beekeepers present including the secretary. Two members from the Ford County association were our visitors.

Our president, Mr. H. J. Bryan, told of his trip in Missouri and of visiting the Missouri State Convention.

About a month later, we had a field meeting at Mr. Miller's home in Chenoa, Illinois. Here we had another very interesting meeting with Mr. A. L. Kildow, chief State inspector, as the speaker.

We were then later invited by the Ford County association to attend their field meeting near Pontiac, Illinois. The meeting was enjoyed by all and the ladies served us with lunch.

Several business meetings were held during the year.

We are busy again this year fighting American foulbrood. We hope to clean up most of the diseased colonies very soon and have the county under control as far as American foulbrood is concerned.

We are planning now for a meeting in the near future.

The officers for last year were re-elected to serve for the following year.

The association regrets with sincere sympathy, the loss of one of our members by death, Mr. Wolcott. He was a very successful beekeeper and took a great interest in the association and its activities. We could always depend on him to attend our meetings and his name shall not be forgotten.

We are looking forward to a good honey crop in this county.

Morgan-Scott County Association.

(Lawrence W. Fisher, Woodson, Secretary.)

The annual meeting was held at the Centenary Church, Jacksonville, Illinois, on December 3, 1931.

A talk was made by the President, T. B. Reeve, covering the progress, success and accomplishment of the association during the year. A short talk was made by the local inspector, A. L. Holmes, giving us a review of the work accomplished in cleaning up the foulbrood situation in this territory. Much progress has been made in his work.

Mr. J. H. McClure gave a very interesting talk of the happenings at the State convention held last month.

On a motion all officers were reelected by acclamation.

After which we adjourned to the dining room of the church where a honey supper was served by the ladies of the church. Entertainment was furnished by a negro quartette.

Several meetings were held at various places throughout the year.

At the October meeting it was decided to hold the annual election and feed by having a pot luck supper at the farm bureau office.

Northwestern Independent Association.
(George F. Hartman, Freeport, Secretary.)

The Northwestern Independent Association of Stephenson County has a membership of twenty-three; hold monthly meetings at different bee yards. Once a year we have an annual picnic when beekeepers and their families gather.

Most of the members paid county association dues, some paying for State affiliation.

The following officers were elected:

E. E. Bauch, President; George Miller, Vice-President; George Hartman, Secretary; J. Faist, Treasurer, and three Directors, K. Voss, J. M. Donalds, and C. Kraft.

We expect to make 1933 a banner year for membership.

Piatt County Association.
(Emory Warner, Monticello, Secretary.)

The annual meeting of the Piatt County Beekeepers' Association was held in the court house in Monticello, January 15, 1932.

The following officers were elected:

Charles Brown, President; E. C. Wyne, Vice-President; Emory Warner, Secretary and Treasurer. Mr. Milum and Mr. Dadant were present.

The next meeting was held at the apiary of Emory Warner in July with thirty present.

Rock Island County Association.
(S. F. Peterson, Moline, Secretary.)

Our association has held no meetings since last October; but am trying very hard to retain all our members. We will have our regular meeting again in September or October, possibly sooner if speakers are available.

Our honey crop is going to be very heavy this year as we have an abundance of white and sweet clover. Although this dry weather may cut it short.

Saline-Gallatin County Association.

(Alvin Bell, Ridgway, Secretary.)

We held four meetings during the year. The first near Eldorado May 19th. The second also near Eldorado on June 28th. The third, an all day meeting with a picnic dinner. It was well attended and held August 5th. A colony of bees was transferred and Mr. A. L. Kildow gave a very interesting talk and discussed topics of interest.

The fourth meeting was held near Ridgway. It was of special interest to the Equality High School agriculture class which also attended it.

Local beekeepers are cooperating enthusiastically with the county's bee inspector in attempting to stamp out American foulbrood in this territory.

The honey flow ended about September 1st; bees going into winter quarters with very light supplies and many beekeepers are faced with the problem of feeding them.

Stark County Association.

(Everett Price, Toulon, Secretary.)

We held our first meeting of the year 1932, March 19th at the court house in Toulon.

Those present, C. N. Gerard & Son, Frank Johnson, Representative W. H. Jackson, Elmer Kommer and Everett Price.

Most of the time was spent discussing politics and American foulbrood and both are bad stuff to deal with. Also talked of trying to get the appointment of Frank Johnson as deputy inspector for Stark County.

Next meeting held at same place March 26th. Only three members present, N. A. Newman, Frank Johnson and Everett Price; also, Wayne Gilbert, farm adviser.

Before our next meeting we secured the appointment of Frank Johnson as inspector.

On December 21st we held our last meeting of the year at the court house. Members present were C. N. Gerard, N. A. Newman, C. T. Egbert, Grover Hollars, Wm. Bacmeister, Frank Johnson, and Everett Price.

Tri-County Association.

(Maud S. Young, Oregon, Secretary.)

Our association held two meetings during 1932; one on April 7th in Oregon, and the annual meeting on September 21st, in Rockford.

At the April meeting, Chief Inspector, A. L. Kildow, who with his wife had recently returned from the South, gave us an interesting account of honey conditions in Florida.

In September, Inspector Kildow, and a neighbor-state inspector, Mr. I. V. Whiting of Wisconsin were present with helpful discussions. The sum of $2.00 was sent to the support of the American Honey Institute.

Officers elected were, Charles Mon, Polo, President; Clyde Wilde, Oregon, First Vice-President; George Sauer, Polo, Second Vice-President, and Maud S. Young, Oregon, Secretary and Treasurer.

ANNUAL REPORT OF THE CHIEF INSPECTOR OF APIARIES FOR THE YEAR ENDING JUNE 30, 1932.

(A. L. KILDOW, Putnam, Illinois.)

To the Honorable, Louis L. Emmerson, Governor of the State of Illinois.

SIR: I have the honor of hereby submitting my annual report of State Inspector of Apiaries for the year ending June 30, 1932.

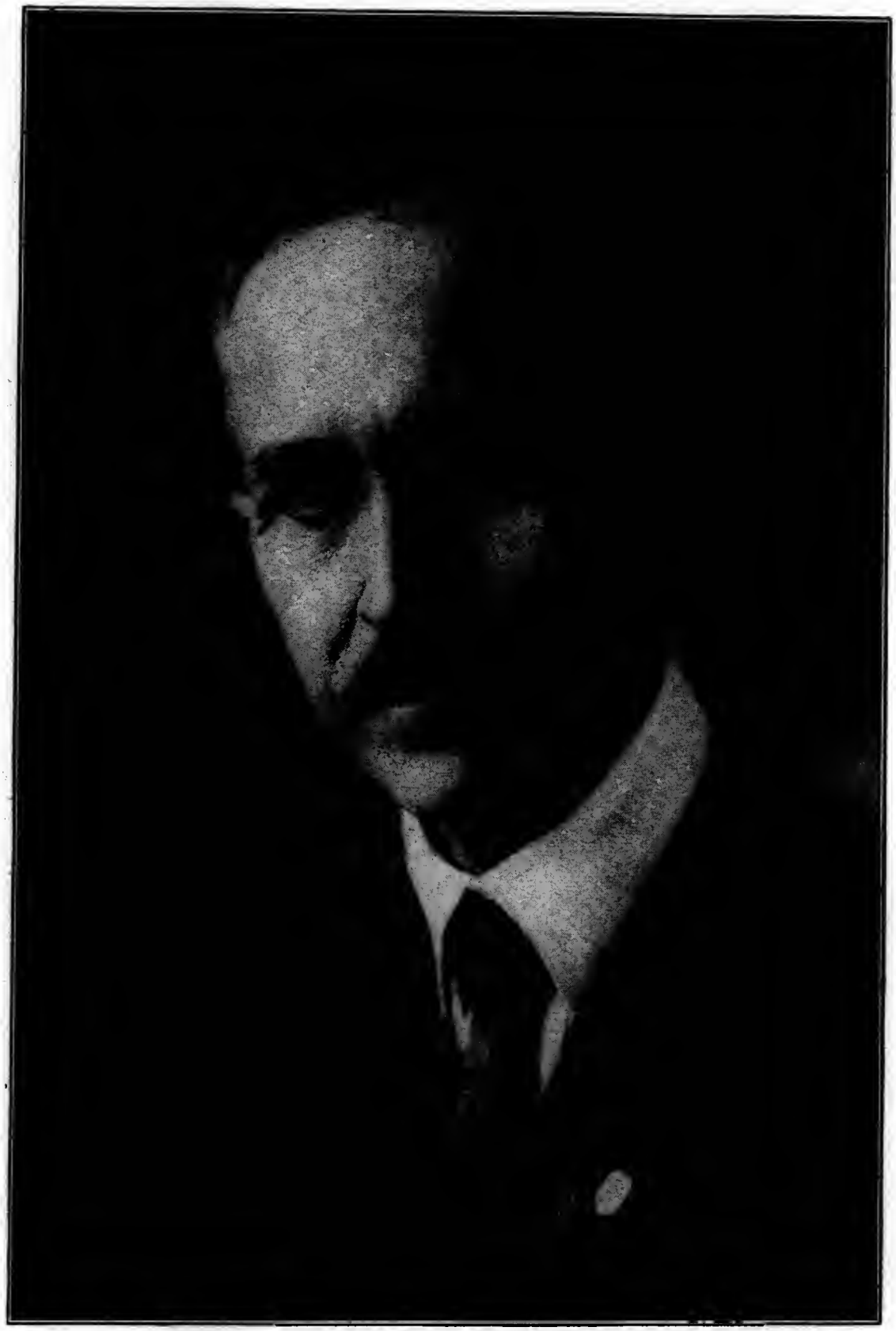
In submitting my report for the year ending June 30, 1932, I will only give a summary of the work done. The main object was to control foulbrood and to eradicate foulbrood we must be persistent and use uniform methods. For this reason we still follow the county organization plan, thus uniting the beekeepers with two main objects in view, one to eradicate disease, and the other to keep bees better and get more honey at the least possible expense.

We visited 8,310 apiaries with 94,878 colonies and found 1,409 diseased apiaries with 6,330 diseased colonies. Two thousand eight hundred ninety-four colonies were destroyed, and 280 were treated. Many of the apiaries visited the latter part of June were not cleaned up until in July, as some of the beekeepers required time to get new supplies or waited for assistance from the inspector. This accounts for the number of diseased colonies not reported cleaned. In some cases where the beekeepers were careful and practical, the diseased colonies were left for the owner to burn, treat, and clean up by following the instructions of the inspector.

There was a great demand for inspection work during the spring and early summer and this kept the inspectors going, which ate into our appropriation, and as our funds were not sufficient to cover the entire State, we were obliged to call a halt in the work, that a reasonable amount might be left for the next spring's work. The spring inspection is very necessary in order to get the bees in readiness for a new crop.

The real purpose of the inspector is to educate the beekeeper, help him to detect disease, show him the best method in handling it and to promote better beekeeping. The only sure method to rid the disease is to burn and this should be done in a systematic and careful manner. The inspector is the beekeeper's friend and will assist him in any way possible. All he asks is cooperation.

Along the educational line of apiculture we have the demonstrations and explanations given to individual beekeepers by the inspectors, the field meets, county meetings and the State Fair exhibit and the Bureau of Information held there. It is only necessary to mention a few of the many county meetings to show the interest taken in the work.



A. L. KILDOW, Chief Inspector of Apiaries.

On September 10, 1931, beekeepers from 20 different counties assembled at the home of A. L. Kildow of Putnam. Among the speakers were Mr. Stuart E. Pierson, Director of Agriculture, who was accompanied by Mr. Emmerick of the Dairy Department, M. G. Dadant and Frank Pellet of the American Bee Journal, Dr. Myers of Hillsdale, Elmer Kommer, treasurer of the State Association, and beekeepers from the different localities. These talks were not only pleasing to the listeners, but very beneficial and many remarked that it was worth the coming just to hear Director Pierson's practical and instructive address. Nineteen inspectors were present to compare notes and get all the information possible to aid in their work. The day was far too short for such an interested group, but all departed taking with them new thoughts and improved methods to be used in their work. A general request was made that another meeting of the north central beekeepers be held next year with the State inspector at his apiary.

On August 11, an all day meeting of the beekeepers of Rock Island was held at Taylor Ridge. Here they not only heard bees, better beekeeping and bee diseases discussed, but they enjoyed a real chicken dinner.

The Woodford County beekeepers assembled at the up to date apiary of Rooke Brothers of Eureka on August 12th. V. G. Milum, State Secretary and Inspector Kildow were present and assisted these people.

On August 16th Ogle and Lee counties held their annual meeting and at that time decided to make it a tri-county association and took Winnebago County in to their fold.

The first of October we had a series of three meetings that we might get speakers for these at less expense than if held at different times. On the 1st the meeting was at Cambridge, Henry County. M. G. Dadant and Inspector Kildow being with them. On the 2nd, the beekeepers of Stark County met at Toulon. M. G. Dadant and G. H. Cale of Hamilton parted some of their knowledge to the beekeepers of this association and Representative Jackson of Toulon expressed his interest in the bee industry. The following day, G. H. Cale and Inspector Kildow met with the Stephenson County beekeepers at Freeport. Mr. Cale explained the necessity of a good location for an apiary in order to make a success of the business.

Another means of education was the State Fair. This reached far beyond the beekeepers in enlightening the public. The exhibits this year were a great improvement over former years. It not only showed the fine work of the bees, but also the artistic arrangement of the products by the exhibitors. There were six exhibitors and the product was so good it made a difficult job for the Judge. Besides the exhibit, there was the Bureau of Information where live bees were shown, the queen bee pointed out and all questions answered by experienced bee men. In this way the public became better informed in regard to apiculture. Our young people have become so interested in this business that we have many amateurs, and some of them will exhibit at our 1932 Fair.

Illinois is a big State with many beekeepers, ranging from the man with one colony, to the commercial beekeeper with six hundred colonies or more. And to make a success of our work and keep apiculture on the move upward we must all cooperate.

It is through the cooperation of the beekeepers, the inspectors and the Department of Agriculture that we attribute success.

In conclusion, we wish to thank all those that have been instrumental in helping us carry out the work of this Division.

REPORTS OF DEPUTY INSPECTORS FOR 1932.

Hardin, White, Saline and Gallatin Counties.

(Deputy Louie Vannis, Harrisburg.)

For the year 1932 I visited 294 apiaries, with a total of 2,864 colonies of bees. One hundred and fifty-five were affected with American foulbrood, and out of the 155 diseased, 22 were treated by owners or inspector, and 133 were burned.

Our fall flow was very poor, and sweet clover did not produce as well at it should this spring. Prospects, however, look good for next year.

Will County.

(Deputy Valentine W. Heussner, Lemont.)

The beekeepers of this and surrounding territory experienced another lean year in 1932. The average per colony in this particular locality will not mount greatly above 40 pounds. A majority of the honey producers had a comparative amount of surplus honey to carry over from previous years, and with a dilatory demand in this depressing interval of time, the distress among beekeepers is less noticeable than in many other occupations.

The American foulbrood area clean-up program previously arranged did not materialize so completely as anticipated, lack of funds being responsible. However, the most hazardous localities were given the most stringent inspection. An abundance of work yet remains to be done, and many scattered cases are visible, particularly in the south and southeastern portion of our county.

Much gratitude is due the members of the Will County Beekeepers Association for their remarkable cooperation extended the inspector in the eradication of the most dreadful enemy of our bee industry. The State-wide economic depression has contributed to establishing new low honey prices, in conformity with other farm commodities. The drought seriously reduced the clover acreage in our immediate vicinity. Bees are in normal condition.

Livingston, Kankakee and Will Counties.

(Deputy J. T. Heinricks, Chatsworth.)

For the year 1932 I inspected 2,832 colonies, of which 332 were diseased (American foulbrood), 2 being treated and 330 burned.

As to conditions, I am writing at this time to say we have been living in hopes for that prosperity to turn the corner, which still is round. We deputies could not work as much as we should due to short-

age of funds, but even so I make it my business to get in some new locality where there never has been any inspection work. That is how I always get a good deal of diseased colonies, and I also want to say this for each and every beekeeper, especially where there is no inspection: "Watch your bees, and bees in trees and buildings for disease." In case anyone north or northeast of Livingston County does not understand, notify me at once. I will be at your service.

Champaign and Partly Vermilion County.
(Deputy W. H. Force, Champaign.)

Reviewing the inspection work done the past season (1932), will say that beekeeping in general has improved very much in this locality, the number of colonies having increased, and some beekeepers have put forth better efforts in the production of honey. While other farm commodities have fallen off in price and employment being very poor, honey seems to bring as good a price or better than a number of other farm products at today's prices.

In speaking of bee diseases we have our share of them. Some of our adjoining counties have had very little inspection work done in them on account of lack of funds. This State needs an appropriation so we can go ahead and make a clean sweep of the disease, since it seems that about the time the inspectors are only fairly well started on their work they have to check in on account of lack of funds. Then when the funds are again available the disease has spread further on. Also we have beekeepers who never get rid of disease as long as they keep bees. We had a case in this district where a beekeeper had spent several hundred dollars for bees and supplies. American foulbrood was his greatest trouble, and instead of treating them in the right way he used a haphazard treatment instead of following out the State instructions. Each time the results were more disease the next year, until this year he had only a few colonies left and they were polluted with American foulbrood, and when asked what he was going to do with them he replied that it didn't make much difference what became of them; that he had about $500.00 worth of empty hives left. We burned all of the diseased bees and while burning them he said he would like to sell all the honey out of them. The inspector told him that had been his trouble all the way long; in treating for the past two or three years he had saved all the honey and later fed it back to the bees. Just such beekeepers is what makes bee disease hard to eradicate and makes it difficult for the other beekeepers—the old saying, "You better take care of old man American foulbrood or he will take care of you" is very true.

On July 15th last, Champaign and Vermilion counties held an all-day meeting at Homer Park, Mr. A. L. Kildow, chief inspector, being present. He gave a lengthy discussion on inspection work. Mr. V. G. Milum also discussed beekeeping problems. The attendance at the meeting was very good, there being about 55 beekeepers present.

In summing up the inspection work this year, my work was mostly confined to localities where there were disease and complaints from beekeepers. During the month of August I did no inspection work on

account of no funds; also very little work being done in June and July. I inspected 3,209 colonies. Out of this number 419 were found to have American foulbrood and 6 European foulbrood, 3 with Sac brood. All of the American foulbrood colonies were either burned or treated; 91 dead American foulbrood colonies burned also. Colonies that were checked up on the second trip not counted in the 3,209.

Will County.

(Deputy George W. Lynn, Lockport.)

During the season of 1932 I visited 73 apiaries and inspected 963 colonies of bees in Will County. I found 96 infected with American foulbrood, of which 68 were treated and 28 burned.

The beekeepers are cooperating with the inspector very satisfactorily and most of them appreciate the State help very much.

White clover and Alsike were a failure this year. The sweet clover yield was fairly good in spots, also basswood, with the quality much better than last year. The fall flow was good, mostly from asters, and colonies with good queens are in fine shape for winter. White clover has made quite a comeback this fall, and if it winters well should yield next year.

In spite of low prices and poor markets that the Will County beekeepers are sharing with the other agricultural workers, most of them are staying on the job and expecting better times for the industry.

Kendall County.

(Deputy John O'Brien, Newark.)

In the year 1932 I inspected 1,001 colonies, of which 79 were diseased and 23 dead. Of these 4 were burned and 54 were treated.

Rock Island and Mercer Counties.

(Deputy Dow Ripley, Aledo.)

During 1932 I visited 62 apiaries, with 917 colonies. Of these 28 colonies were diseased (American foulbrood), which were burned. Very little European foulbrood. The box hives are about a thing of the past in Rock Island and Mercer counties. Found 8 box hives at the State Park. The bees were taken from boxes that were put up for the birds. While it is fine to have the bees in our parks, I think they should be in standard hives.

We have only a fair honey crop, but the demand is not much better than the crop. Very few beekeepers care to shake American foulbrood. They have found it does not pay.

Bees went into winter quarters in very good shape.

Iroquois County.

(Deputy J. N. Koritz, Buckley.)

In the year 1932 I inspected 1,403 colonies, and of this number there were 148 colonies that had American foulbrood. Also in this number were 24 box hives. I transferred 4, burned 12, also found some of

the beekeepers who had disease in their apiaries had done good work in cleaning up by transferring and burning.

The general condition of the bee industry in this county is fairly good, except in the northern part of county, which is not so good. Some parts are badly infected with American foulbrood, but at that, the beekeepers in the northern part of county have made a good start at cleaning up.

Most of the beekeepers are willing to learn and cooperate with the inspector.

DuPage County.

(Deputy Wm. Wallanches, Downers Grove.)

During the year 1932 I inspected 1,285 colonies in 187 apiaries, of which there were 61 box hives. There were 107 colonies having American foulbrood, of which 48 were treated by owner and inspectors, balance burned by inspector and a few by owner.

Most of the diseased colonies that were burned were at the first visit, the owners cooperating with me. The beekeepers produce about an average of 60 pounds per colony, gathered mostly from sweet clover and basswood. This fall considerable white clover is springing up, and I look forward for a better 1933 white clover crop, which we have not had for the last two years.

I believe the beekeeping industry has more outlets for disposing honey than ever before, and is greatly helped through the work of the American Honey Institute.

Piatt County.

(Deputy Emory Warner, Monticello.)

For the time I worked this year (1932), I examined 2,408 colonies, finding 226 with American foulbrood, and burned 211, while the owners treated 15 by shaking.

The bees went into winter quarters in very poor shape in this location for those who were depending on stores from the fall flow, as there was no fall flow here. However, the summer flow was good and of a good quality. Most of the beekeepers in this locality are farmer beekeepers and are rather discouraged because of farm prices, but are taking better care of the bees as to production and marketing from an added source of income. Honey is moving right along here as the fruit crop was poor here this year. We are pushing the sale of honey by making displays in grocery stores and giving out the pamphlets furnished by the Kellogg Company.

It has been almost impossible to get the dollar dues but we are working up a scheme to have beekeepers bring in honey in place of cash for their dues.

Perry and Randolph Counties.

(Deputy Roy I. Annear, Mulkeytown.)

From July 1, 1931, to July 1, 1932, I inspected 3,096 colonies. I found American foulbrood scattered over both counties. Some colonies

were burned (69), and 117 treated. I did most of the burning, also most of the treating or transferring.

I have found that the average beekeeper trying to transfer a diseased colony only makes matters worse in the surrounding community, so I think it is best for the inspectors in most cases to supervise the job or do it himself. It is very discouraging to beekeepers to transfer diseased colonies one year and then go back the next year and the same colonies have to be transferred again or burned. This makes one feel as if your instructions on the treatment had failed, while in nine cases out of ten they did not follow instructions.

Beekeeping is improving each year, in spite of the depression or poor honey prices. The acreage of sweet clover is increasing and the pounds per colony too.

Ogle and Lee Counties.

(Deputy S. S. Claussen, Oregon.)

In 1932 I visited 155 apiaries, totalling 3,066 colonies of bees, of which 453 were diseased with American foulbrood. Forty-seven of these were treated and 406 were burned.

I think we have cut down foulbrood wonderfully since I started doing inspection work, but there is always some showing up again in some localities, due to carelessness.

Honey crops were not large around here, but of good quality. I think the bee industry is good, considering other lines of business. Of course honey is lower in price than other years, but price is still good compared to other commodities.

Macon, DeWitt and Shelby Counties.

(Deputy Otis L. Stone, Decatur.)

In 1932 I visited 321 apiaries and inspected 2,110 colonies. Found 299 with American foulbrood. Two hundred and sixty-five were burned and 34 treated. I feel that between the Macon County and Shelby County Beekeepers' Association and myself we did a big thing in eradication of American foulbrood in DeWitt, Macon and Shelby counties. In 1931 I found 982 diseased as against 299 this year, and if I can reduce this disease that much in 1933 I know everybody will be pleased.

The behavior of the bees has been good. They did not do much swarming, and went into winter quarters in good shape with plenty of stores. The honey crop was good; all bees taken care of and well supplied produced abundance of honey, both section and extracted. The main source was sweet clover.

Kane County.

(Deputy Ross R. Morrill, Batavia, Route 1.)

In 1932 I worked 18 days, and in this time visited 120 apiaries, with 1,243 colonies; opened 908 colonies. I found 111 with American foulbrood, burned 94 and allowed 17 to be treated.

Most of the diseased colonies I find are moved in from other counties. I don't say there isn't any American foulbrood in this county for there is; but these diseased apiaries are moved from county to county and it is a very hard thing to get your hands on the owners. Then of course it is very hard to locate all the bees on 36 miles of Fox River, where there are several large cities.

Grundy County.

(Deputy F. J. Anderson, Morris.)

During the year of 1932 I inspected 23 apiaries with 254 colonies. I found 17 colonies with American foulbrood, which I burned. The bees stored more honey to the hive this year than last year, and the bees went into winter quarters heavy with honey.

Henry and Warren Counties.

(Deputy Elmer Kommer, Woodhull.)

During the year of 1932 the following work was done by me in these counties.

I inspected 2,175 colonies, out of which I found 4 with European foulbrood and 257 with American foulbrood.

Out of this amount of American foulbrood we burned 98 colonies and the rest were treated.

I found there were still 166 colonies in box hives where the frames could not be removed, or without frames at all.

Several bee trees were also destroyed by killing the bees and plugging up the entrances in trees. The big percentage of infection was caused by careless moving of bees by ignorant beekeepers, where in one case a few box hives were moved into town and transferred, and then the bees allowed to rob out the honey after transfer was made. Most of the bees in that part of the city were infected, as the combs from these box hives showed signs of infection from American foulbrood. However, the beekeepers were all willing to cooperate with me in this cleanup, and most of the bees were shaken, some burned. It was right in fruit bloom where treatment could be done satisfactorily, and upon later checking up on these I found 100 per cent successful treatment. Most of the colonies shaken stored a good crop of surplus.

The Kewanee territory is still in excellent shape as I only found two yards that had any disease in them, four in one yard and one in the other. One was burned, while the other four were shaken.

I suspect in this Kewanee case that the disease came from old hives or supers that were not thoroughly cleaned, as they had plenty of foulbrood a few years back when Kewanee had 25 per cent infection.

I found a new outbreak of disease only 3 miles from my own yard this year in territory that had always been free, but with cooperation from the beekeepers we soon got rid of the disease.

I spent some time working in Warren county by request of the beekeepers in that county, and found considerable disease there, while in some spots in that county disease has completely wiped out the yards,

as I made visits at place after place where bees were kept eight years ago and they reported that the bees had died and they were out of the beekeeping industry.

Warren county needs a good inspector who knows disease and how to eradicate same. The beekeepers in that county are also splendid cooperators and are anxious to get rid of the disease in that county.

My opinion of the Bee Law is that it is not strong enough. We should have a law that would prohibit moving bees at all except by permit from the inspector, and by so doing we could find those who have only a colony or two on the "let-alone" plan, which the inspector never finds.

JoDaviess County.

(Deputy C. W. Duerrstein, Galena.)

For the year of 1932 I visited 92 apiaries and inspected 1,523 colonies. I found 16 colonies to be infected by American foulbrood. These colonies were destroyed by burning, either by the owner or myself.

The first part of the season did not appear very good for surplus, but we had a good flow of basswood honey later, therefore we have about a two-thirds crop. We have had a very good flow this fall and as the quality of the honey is good, the bees should winter all right.

Ford County.

(Deputy Chester E. Dueringer, Gibson City.)

During the year 1932 I inspected 660 colonies and found 97 infected with American foulbrood. These were found in new territory, also in territory that had been inspected. 47 colonies were burned by owner and inspector, and 55 colonies were transferred into new hives.

The bee industry has improved in some parts of the county, but there is still plenty inspection to be done. Beekeepers seem much more interested in ridding their colonies of the disease.

DeKalb and Boone Counties.

(Deputy Carl H. Tudor, Sycamore.)

Please accept this as my report for the year 1932. Began work in April and closed work in September. No work for August. I called at 164 homes of bee men, with a total of 2,839 swarms of bees. Inspected 1,910 and found 88 affected with American foulbrood. 77 of these were burned and 11 were treated. It looks to me as though bees are getting better care. There is not as much American foulbrood as formerly. DeKalb county had a spotted flow of honey this year; the south part had a fine crop, while the north part was not as good. New swarms that were late will have to be fed. No rains in June and July was the cause. The fall rains have started the clover, and other plants look good for another year. Boone county had dry weather and no honey to speak of—if anything it was worse than the north part of DeKalb county.

Fulton County.

(Deputy F. R. Belt, R. 7, Canton.)

During the year 1932 I inspected 922 colonies of bees. In the months of May and June I found 313 had American foulbrood of which 207 were burned by inspector or owner, and 106 treated. On an 8-day checkup in September I inspected 464 colonies and found 17 American foulbrood, which were burned.

Lake County.

(Deputy C. P. Jankowski, Gurnee.)

During the year 1932 I visited 134 apiaries totalling 1,174 colonies, of which 61 colonies were diseased with American foulbrood, and of these 15 colonies were burned and 46 colonies treated. The American foulbrood seems to appear only in colonies that were shaken in the previous season; otherwise the American foulbrood is gradually disappearing.

(Deputy Edw. M. Klein, Gurnee.)

I find in looking over my records that I put in 7 days inspection work in June, during which time 45 apiaries were given a complete inspection. These 45 apiaries contained 465 colonies of which 131 were found to be diseased. Some of these were burned on the spot (61) by the inspector and 70 colonies were treated by the owners, where a reasonable degree of success seemed probable.

An additional 6 days inspection was done in September, during which time all apiaries which showed any disease in the June inspection were gone over again. In most every case no disease was to be found on the second inspection. A number of new yards which had not been gone over in the June inspection were included in the September inspection.

Due to the low price of honey and wax, beekeepers do not seem to be so anxious to treat their bees as formerly, which is resulting in few beekeepers and smaller apiaries. Disease is on the decrease, but it seems a slow and costly method by the treatment route.

I believe that the sooner the State demands that all diseased colonies be burned by the inspectors wherever found the better it will be for everyone concerned.

McHenry County.

(Deputy Ray J. Bartholf, Richmond.)

For the year 1932 I started work May 4th. I visited 216 apiaries, totaling 3,109 colonies of bees, of which I examined 2,583 colonies. I found 327 colonies diseased with American foulbrood. Thirteen were treated by the owners and the remainder were destroyed and burned by myself and owners. Most of the beekeepers appreciate what the State is doing for them in inspection work, as there are only one-half as many diseased colonies this year as there were in the year 1931. Some of the beekeepers of McHenry County depend on their honey crop for their

income, and some of them keep a few colonies for their own use. Most of the colonies are fairly well supplied with stores, as the late fall flow was very good.

Edgar, Clark and Crawford Counties.
(Deputy Maxel Mapes, Paris.)

I have done considerable work in each of these counties during the past three seasons.

On my first visit to communities where my services have been requested, I have usually found considerable American foulbrood infection, in fact in some cases this amounted to almost 100 per cent and the entire apiary was doomed.

I have found beekeepers generally very appreciative of my services, and usually glad to comply with my requests.

In the communities where I have made inspections semi-annually over a period of three seasons American foulbrood has almost disappeared.

A large percentage of my work has been done between Illinois State Route 1, and the Illinois and Indiana State Line.

I have not been able to thoroughly inspect all of this territory but have confined my activities to communities where my services have been requested.

Hancock County.
(Deputy Harry T. Kirlin, Warsaw.)

I inspected 61 apiaries in Hancock and McDonough counties. Found American foulbrood in 5 apiaries. A total of 29 colonies were found with American foulbrood and burned.

This disease was not spread over a very large territory. Sixteen cases were in one yard. We burned the entire yard. I inspected 2,718 colonies in the year of 1932. Most of this was in Hancock County.

McLean County.
(Deputy George Schwinn, Pekin.)

I inspected two thousand one hundred seventy-six colonies, thirty-four of which were diseased. Two were treated for European foulbrood; treated sixteen for American foulbrood and burned fifteen. There were ninety-eight box hives.

Most disease was found in Normal. I found only one place, or yard, otherwise, which had completely died out of American foulbrood, and that was in Cloverdale. If I have the job again next year, I intend to go to this neighborhood pretty early in the spring to see whether any other yards show infection.

I knew from past experience that my "time" was liable to be cut short, so I tried to get over as much ground as possible in as short a time as I could. So when I found people agreeable, I did not go back to see whether or not they had obeyed orders, but just kept going to find other cases. My record shows that I found two cases of European foulbrood, and thirty-one cases of American foulbrood; I know the European foul-

brood was treated, because I removed the Queen in one of them myself, and had Mr. H. J. Brian of Normal help the man to introduce a new Queen; the other case was in one of the yards of Rocke Bros., of Morton, and I am sure they treated because they are 'up and coming' efficient beekeepers who will not tolerate disease if they know it is present, and if they are not sure, they won't hesitate to call on someone who is supposed to know. That disposes of European foulbrood.

As to the other, so far as I know, sixteen cases were treated by the owner; the rest were burned, or rather ordered to be, and I feel satisfied that they were because it was plain to me the owners realized it was the best thing to do. But that does not clean up, because these colonies usually were dead when found, and the hives had been standing there, exposed to all the bees that wanted to help themselves. So it seems to me, there is a good prospect of finding a good deal more of it next summer.

Morgan, Scott, Cass and Pike Counties.

(Deputy A. L. Holmes, Jacksonville.)

Number of colonies inspected were 1,055, and found 167 of these diseased; treated 6 and burned 68. Visited 65 apiaries, 30 of which were diseased.

In addition to above, 99 diseased colonies were left for the owners to treat or burn, in most cases owners agreeing to burn or render combs.

Owing to unfavorable weather, inspection work was delayed until May, making but one trip in April to Nebo, Pike County. Here some American foulbrood was found and in Morgan County where so much disease was cleaned up last year, I found some 9 per cent infection and this confined to apiaries showing American foulbrood last year.

In Scott County my work was mostly where no inspection was done in 1931 in the Exeter, Bluffs and Naples region American foulbrood had a big start, some, 36 per cent of all colonies in affected apiaries showing disease. The beekeepers there want to clean up foulbrood and we did a lot of burning while I was there, some beekeepers where we did not burn at that time agreeing to burn or kill the bees and render combs.

Near Alsey in Scott County one apiary was found infected with American foulbrood this we burned while there, no disease showing in other apiaries near, the owner had used some old hives, bees had died in some years ago at best, a risky thing to do. Including all colonies in apiaries visited in Scott County some 19 per cent were infected with American foulbrood.

At Beardstown in Cass County, conditions were much better during the early part of the season than in 1931. No later visit was made there.

At Chambersburg, Pike County was another bad spot of American foulbrood, some 40 per cent of all colonies there showing infection. All the beekeepers there wanted to clean up and we burned all the diseased colonies and many empty hives where bees had died.

Our main crop this year in Morgan and Scott counties was from sweet clover and apiaries located near good fields of sweet clover harvested a fair crop, our own crop was about the same as last year but

there was very little yield from fall flowers and bees used a great deal of the early honey during August and September.

Many beekeepers are discouraged with poor crops and low prices and give their bees very little attention say they cannot sell the honey when they have a crop, prices are lower than last year and sales have been fair for good quality honey where the beekeeper pushed the sales end of the business.

LaSalle County.

(Deputy H. W. Hoffman, Peru.)

I have, in the year of 1932, inspected 1913 colonies of which I found only 39 which had American foulbrood. Seven of the 39 were treated and the remaining 32 were burned.

This is only a fraction of the number of colonies which I found diseased in 1931. In 1931 I found 231 which had disease and burned all of them; I find this the best remedy.

I received several letters from beekeepers who desired information concerning the management of bees, all of which I answered. It was indeed a pleasure to have an opportunity to help those who want to learn more about the modern method of beekeeping.

I also find that the fact the prices of hives, supplies, equipment, etc., is still rather high and the price of honey lower, seems to discourage the beekeepers.

In the year 1931 I spoke to all beekeepers using box hives and encouraged the use of standard equipment. I also pointed out the advantages they had over the old method of beekeeping. This year I find that about three-fourths of those who had been using box hives have changed over to standard equipment and I feel that the remainder will do so in a short time.

I sincerely hope that the coming year will be a greater year for the beekeeper and that he will enjoy a fancy price for his honey.

Franklin and Jefferson Counties.

(Deputy R. C. Meredith, Whittington.)

Out of the 1,624 colonies I inspected, I burned 34 colonies and treated 11. Some of the cases of American foulbrood were cleaned up by the owners at my request. 807 of the colonies inspected were box hives and the most of them were in a very dilapidated condition.

All of the cases of foulbrood was American foulbrood. I met hearty cooperation with all beekeepers and all cases were cleaned up before the season closed.

We have had a rather unfortunate year for making honey. Honey is scarce in this locality and what little there is, is not of a very good grade. But I hope we can keep up an interest among the beekeepers and make next year a better year than we have ever had yet.

Woodford County.
(Deputy Benjamin H. Fischer.)

In looking back over my 1932 records I find that I have inspected 619 colonies in 64 apiaries; of these, 66 were infected with American foulbrood, and 7 with European foulbrood. All diseased colonies were treated or burned. 10 diseased apiaries were reinspected during September. In two apiaries the owners failed to follow instructions and diseased colonies were burned by the inspector.

Owing to the trouble and carelessness of a beekeeper in Cazenovia, (he was later taken to an insane asylum) there was very bad reinfection in that neighborhood. The above mentioned beekeeper lost, during the winter of 1931-32, 36 of his 40 colonies with American foulbrood which was a good example to those who would not believe in bee diseases. Outside of that neighborhood there was only a small amount of disease in spotted areas.

The honey crop here was about a normal crop, averaging about 125 pounds per colony.

Mason and Logan Counties.
(Deputy S. A. Tyler, San Jose.)

During April, May and July, I examined 1,435 colonies in 71 apiaries. American foulbrood was the disease found in 62 of these colonies. The percentage diseased was .043 per cent.

The bees are going into winter in good shape. We have had a good crop of sweet clover honey, but not much of any other kind; no honey dew this year at all.

Honey is moving nicely at prices better in proportion than most any other agriculture product.

Stark County.
(Deputy Frank Johnson, Toulon.)

Yards visited, 100. Number of colonies, 536, of these 116 were diseased; 107 treated and 64 burned. There were 92 box hives.

ILLINOIS CONTRIBUTIONS TO THE AMERICAN HONEY INSTITUTE—APRIL 1, 1932 TO MARCH 31, 1933.

Supporting Members:	
Dadant & Sons, Hamilton, Illinois	$500.00
American Can Company, Chicago, Illinois	50.00
A. I. Root Company of Chicago, Chicago, Illinois	20.00
Total from supporting members	$570.00
Individual Beekeepers:	
W. C. Moon, Henry	5.22
S. Pitts, Stronghurst	4.87
C. J. Anderson, Morris	8.00
E. A. Meineke, Arlington Heights	20.00
Harvey Foote, Green Valley	.60
Edgar Gnitzinger, DesPlaines	.50
Ross R. Merrill, Batavia	2.70
Chas. M. Mackly, 1020 Fourth Street, Peoria	.50
S. W. Gooch, 406 South Adams Street, Peoria	.50
Rue Seed Company, 418 South Adams Street, Peoria	.50
Edward Adam, Straun	5.00
Frank Haan, DesPlaines	6.00
Champaign County Association Members:	
V. G. Milum, Champaign	4.00
Cook-DuPage County Association Members:	
Adam Bodenschatz, Lemont	1.00
C. L. Duax, Chicago	1.00
Brother Frederick, Techny	5.00
A. G. Gill, Chicago	1.00
M. Guthrie, Chicago	1.00
E. J. McCormick, Chicago	1.00
Gun Mozee, Chicago	1.00
C. F. Rife, Naperville	2.00
Mrs. Eleanor Simmer, Chicago	1.00
W. J. Wallanches, Downers Grove	1.00
Harry R. Warren, Chicago	5.00
Wm. Young, Chicago	1.00
DeKalb County Association Members:	
L. A. Dean, Big Rock	2.70
C. Holm, Genoa	2.00
Ogle-Lee County Association Members:	
George Sauer, Polo	1.50
Peoria County Association Members:	
S. B. Moon, Peoria	3.00
C. G. Strieder, Brimfield	1.00
Rock Island County Association Members:	
H. G. Frymier, Carbon Cliff	1.00
Woodford County Association Members:	
Lawrence Rocke, Roanoke	1.00
St. Clair County Association Members:	
Phillip Krebs, Marissa	1.00
Total from 33 beekeepers	$92.59

County Associations:	
Macon County Association	$ 5.00
McHenry-Lake County Association	10.00
Morgan-Scott County Association	4.27
Peoria County Association	5.00
Tri-County Association	2.00
Total from 5 county associations	$26.27

BEES AND HONEY PREMIUM WINNERS—1932 ILLINOIS STATE FAIR.

A. L. KILDOW, Superintendent.

VIRGIL E. ROCKE, Judge.

Bees and Honey—Class J—Lot 114.

Case of white comb honey, 24 sections—No. 3284.....$7 $5 $3 $2 $1

First, Walter I. Wright, Tiskilwa, Illinois, Route 3; 2nd, John R. Wooldridge, 2021 West Seventieth Street, Chicago, Illinois; 3rd, Edwin Kommer, Cambridge, Illinois, Route 4; 4th, L. Peterson, 1325 Pine Street, Kewanee, Illinois; 5th, C. F. Earle, Dalton City, Illinois.

Case of amber comb honey, 24 sections—No. 3249.....$7 $5 $3 $2 $1

First, Edwin Kommer, Cambridge, Illinois; 2nd, John R. Wooldridge, Chicago, Illinois; 3rd, C. F. Earle, Dalton City, Illinois; 4th, L. Peterson, Kewanee, Illinois; 5th, Adam Bodenschatz, 610 Porter Street, Lemont, Illinois.

Frame of comb honey for extracting—No. 3250.....$6 $4 $2 $1

First, Adam Bodenschatz, Lemont, Illinois; 2nd, J. R. Wooldridge, Chicago, Illinois; 3rd, C. F. Earle, Dalton City, Illinois; 4th, Edwin Kommer, Cambridge, Illinois; 5th, L. Peterson, Kewanee, Illinois.

Collection of labeled cases, each containing 12 or more sections of white and amber honey—No. 3250A.....$10 $7 $4 $2 $1

First, Edwin Kommer, Cambridge, Illinois; 2nd, C. F. Earle, Dalton City, Illinois; 3rd, Walter I. Wright, Tiskilwa, Illinois; 4th, Adam Bodenschatz, Lemont, Illinois; 5th, J. R. Wooldridge, Chicago, Illinois.

Display of comb honey, not less than 250 sections—No. 3251.....$50 $35 $25 $20 $15

First, L. Peterson; 2nd, Edwin Kommer; 3rd, Adam Bodenschatz; 4th, C. F. Earle, Dalton City, Illinois; 5th, J. R. Wooldridge.

Display of light extracted honey, 40 to 60 pounds—No. 3253.....$10 $5 $3 $2 $1

First, J. R. Wooldridge; 2nd, L. Peterson; 3rd, Edwin Kommer; 4th, C. F. Earle; 5th, Adam Bodenschatz.

Display of amber extracted honey, 40 to 60 pounds—No. 3253.....$10 $5 $3 $2 $1

First, C. F. Earle; 2nd, L. Peterson; 3rd, Edwin Kommer; 4th, Adam Bodenschatz; 5th, J. R. Wooldridge, Chicago, Illinois.

Display of extracted honey, not less than 250 pounds—No. 3254.....$40 $30 $25 $20 $15

First, Edwin Kommer; 2nd, L. Peterson; 3rd, J. R. Wooldridge; 4th, Adam Bodenschatz; 5th, C. F. Earle.

Display of candied honey, not less than 150 pounds No. 3255.....$35 $25 $20 $15 $10

First, J. R. Wooldridge; 2nd, Edwin Kommer; 3rd, L. Peterson; 4th, Adam Bodenschatz.

Display of designs in comb honey, executed by the bees under the control of the apiarist—No. 3256.....$20 $15 $10 $5

First, Edwin Kommer; 2nd, J. R. Wooldridge, Chicago, Illinois; 3rd, C. F. Earle; 5th, Adam Bodenschatz.

One frame observation hive, three-banded Italian bees with queen—No. 3257.....$8 $6 $4 $2

First, Adam Bodenschatz; 2nd, J. R. Wooldridge; 3rd, C. F. Earle; 4th, L. Peterson; 5th, Edwin Kommer.

One frame observation hive, Golden Italian bees with queen —No. 3258.....$8 $6 $4 $2

First, Adam Bodenschatz; 2nd, J. R. Wooldridge; 3rd, Edwin Kommer; 4th, C. F. Earle.

One frame observation hive, any other race except hybrids, three-banded and Golden Italian bees with queen, correctly named—No. 3259.....$8 $6 $4 $2

First, J. R. Wooldridge; 2nd, C. F. Earle; 3rd, Adam Bodenschatz; 4th, Edwin Kommer.

Display of beeswax, not less than 25 pounds of wax moulded by apiarist—No. 3260.....$25 $15 $12 $9 $6

First, Edwin Kommer; 2nd, J. R. Wooldridge; 3rd, C. F. Earle; 4th, L. Peterson; 5th, Adam Bodenschatz.

Art designs in beeswax, not less than 5 pounds—No. 3261.....$15 $10 $8 $6 $4

First, J. R. Wooldridge; 2nd, L. Peterson; 3rd, Adam Bodenschatz; 4th, Edwin Kommer; 5th, C. F. Earle.

Honey vinegar, one-half gallon, with recipe for making— No. 3262.....$4 $3 $2 $1

First, J. R. Wooldridge; 2nd, Edwin Kommer; 3rd, L. Peterson; 4th, C. F. Earle.

Sweepstakes—No. 3263.....Ribbon Ribbon Ribbon

First, J. R. Wooldridge; 2nd, Edwin Kommer; 3rd, Adam Bodenschatz.

Case of white comb honey, 24 sections—No. 3264—Lot 115...$5 $3 $2

First, Wm. M. Hassler, Route 4, Princeton, Illinois; 2nd, Ed. Dennis, Casner, Illinois; 3rd, Hoyt Taylor, Pleasant Plains, Illinois; 4th, Gertrude Ernst, Farmingdale, Illinois.

Case of amber comb honey, 24 sections—No. 3265.....$5 $3 $2

Not shown.

Light extracted honey, 24 1-pound labeled jars. Amateurs—No. 3266.....$5 $3 $2

First, Ed. Dennis; 2nd, Hoyt Taylor; 3rd, Wm. M. Hassler.

Amber extracted honey, 24 1-pound labeled jars. Amateurs—No. 3267.....$5 $3 $2

First, Wm. M. Hassler; 2nd, Ed. Dennis; 3rd, Hoyt Taylor.

One frame observation hive, three-banded Italian bees with queen. Amateurs—No. 3268.....$5 $3 $2

First, Wm. M. Hassler; 2nd, Hoyt Taylor.

One frame observation hive, Golden Italian bees with queen—No. 3269.....$5 $3 $2

First, Ed. Dennis, Casner, Illinois.

Display molded beeswax, not less than 10 pounds—No. 3270...$7 $5 $3

First, Ed. Dennis; 2nd, Wm. M. Hassler; 3rd, Hoyt Taylor.

Best arrangement of the above entries and additional materials for an attractive display. Amateurs—No. 3271.....$12 $8 $5

First, Ed. Dennis; 2nd, Hoyt Taylor; 3rd, Wm. M. Hassler.

Amateur sweepstakes—No. 3272.....Ribbon Ribbon Ribbon

First, Ed. Dennis; 2nd, Hoyt Taylor; 3rd, Wm. M. Hassler.

HONEY COOKERY PREMIUM WINNERS—1932 ILLINOIS STATE FAIR.

Culinary and Pantry Stores

Lot No. 142—Bread, Rolls, Etc.

3524—Honey Oatmeal Gems. Mary E. Rohrer, 1915 South Seventh Street, Springfield, Illinois, 1st; Mrs. Harry L. King, Route 5, Springfield, Illinois, 2nd; A. B. Kussmaul, 1915 South Seventh Street, Springfield, Illinois, 3rd.

3525—Honey Gingerbread. Gesina Memken, Farmingdale, Illinois, 1st; Mrs. Nelson Allyn, 452 South Grand, West, Springfield, Illinois, 2nd; E. Birnbaum, Divernon, Illinois, 3rd.

3526—Plain Honey Bread. Mrs. Opal Hayes, Franklin, Illinois, 1st; Mrs. John Milgrim, 308 Lind Street, Quincy, Illinois, 2nd; Mrs. Harry Whitlock, Franklin, Illinois, 3rd.

3528—Honey Muffins. Mrs. Harry Schumacker, Farmingdale, Illinois, R. R. 1, 1st; Gesina Memken, Farmingdale, Illinois, 2nd; A. B. Kussmaul, Springfield, Illinois, 3rd.

3549—Honey Devil's Food, chocolate icing. First, Mrs. F. L. Caruthers, Lowder, Illinois; 2nd, Mrs. Opal M. Hayes, Franklin, Illinois; 3rd, Mrs. Geo. Carder, 217 North University Street, Normal, Illinois; thirteen entries.

3550—Honey White, white icing. First, A. B. Kussmaul, 1915 South Seventh Street, Springfield, Illinois; 2nd, Mrs. H. L. Whitlock, Franklin, Illinois; 3rd, Mrs. Dale Seymour, Franklin, Illinois; ten entries.

3551—Honey Yellow, white icing. First, Mrs. Dale Seymour, Franklin, Illinois; 2nd, A. B. Kussmaul, 1915 South Seventh Street, Springfield, Illinois; 3rd, Mrs. Harry Schumacker, Farmingdale, Illinois, Rural Route 1; nine entries.

3572—Honey Cookies, Honey Crisp Wafers. First, Mrs. Harry Whitlock, Franklin, Illinois; 2nd, Balanche Brown, Cantrall, Illinois; 3rd, Mrs. Opal M. Hayes, Franklin, Illinois; twelve entries.

3573—Honey Date Bars (Inside). First, Mary E. Rohrer, 1915 South Seventh Street, Springfield, Illinois; 2nd, Mrs. Opal M. Hayes, Franklin, Illinois; 3rd, Gesina Memken, Farmingdale, Illinois; thirteen entries.

3574—Honey Gingersnaps. First, Mrs. Harry Whitlock, Franklin, Illinois; 2nd, Mrs. Dale Seymour, Franklin, Illinois; 3rd, Mrs. Opal M. Hayes, Franklin, Illinois; eleven entries.

3575—Honey Hermits. First, Mrs. Dale Seymour, Franklin, Illinois; 2nd, Mrs. Harry L. King, Route No. 5, Box 139, Springfield, Illinois; 3rd, Mrs. Harry Whitlock, Franklin, Illinois; sixteen entries.

3576—Honey Oatmeal Cookies—1st, Mrs. F. L. Caruthers, Lowder, Illinois; 2nd, Mrs. Emma Fargo, 1431 Maryland Avenue, Springfield, Illinois; 3rd, Mrs. Opal M. Hayes, Franklin, Illinois; seventeen entries.

3587—Honey Divinity. First, Velma Fanning, 512 East Morton Avenue, Jacksonville, Illinois; 2nd, R. R. Gourley, 123 North Glenwood, Springfield, Illinois; 3rd, Mrs. A. R. Cumming, 619 Columbia Avenue, Springfield, Illinois; fifteen entries.

3588—Honey Fudge. First, Mrs. H. L. Whitlock, Franklin, Illinois; 2nd, Mrs. Opal M. Hayes, Franklin, Illinois; 3rd, Gertrude Ernst, Farmingdale, Illinois; fifteen entries.

3589—Honey Nougat. First, A. B. Kussmaul, 1915 South Seventh Street, Springfield, Illinois; 2nd, Mary E. Rohrer, 1915 South Seventh Street, Springfield, Illinois; 3rd, Mrs. H. L. King, Rural Route No. 5, Springfield, Illinois; seven entries.

SAMUEL CUSHMAN.

A Friend of Beekeepers and Beekeeping.

We meet many beekeepers but only occasionally one who is all absorbed in bees. Only occasionally is love of beekeeping the drive within the soul. Only occasionally does a man devote himself in the desire to learn or discover new methods of manipulation or procedure for the good of beekeeping. Samuel Cushman thought bees; he read bee literature widely; he loved bees. Bees were his avocation and his recreation. In bees he was close to nature and his God.

Mr. Cushman taught beekeeping in the Rhode Island Agricultural College in the 80's, thus being one of the first to give beekeeping courses. He continued his interest in bees at different places until he came to Chicago in the year 1921. He almost at once began beekeeping here and gradually increased to nearly one hundred colonies. His interest was especially in comb honey production. He took seriously the writings of others, but wanted to test for himself. His pleasure was more in seeing what one or another breed of queens would do and in testing one make of hives or supers against another; in experiment rather than in cash returns. This is an admirable trait and it was fine that he would thus devote himself.

When Mr. Cushman came to Chicago, he went out into all parts of the city and county making friends with beekeepers. He urged the beekeepers to organize an association and largely through his persistence the Cook County Beekeepers' Association was started in 1922; and through the impetus he gave it as president for two terms, it has continued in good vigor until the present. He greatly aided as well in securing needed State legislation and appropriations for bee inspection.

Mr. Cushman passed away in death, leaving many friends among beekeepers March 3, 1933, at the age of seventy-three years and his body was laid to rest in the family plot in Pawtucket, Rhode Island, March 7.

STATE LAW ON BEE DISEASES

DESCRIPTION AND TREATMENT

Illinois Department of Agriculture

S. E. PIERSON, Director

SPRINGFIELD

APIARY DIVISION

A. L. KILDOW, Chief Inspector

PUTNAM, ILLINOIS

CIRCULAR NO. 261

NOVEMBER, 1927

The following material relating to bee diseases has been copied from Circular No. 261 (November, 1927), Illinois Department of Agriculture, at the suggestion and by permission of A. L. Kildow, Chief Inspector, Putnam, Illinois.

(Prepared by A. L. Kildow, Chief Inspector, Putnam, Ill.)

This bulletin is published especially to acquaint the public with the destructive bee diseases which are prevalent in the State and to show methods of controlling them. It is not the purpose of the State law to require the destruction of property, but on the contrary to conserve the property of beekeepers as much as possible and to place beekeeping on a paying basis. The owners of bees should do all in their power to eliminate bee diseases, and it is to the interest of every beekeeper, when disease is found among his bees, to observe and carry out treatment recommended. Some of the largest beekeepers in the State have had to fight bee diseases, and lessons thus learned have made them better beekeepers.

The treatments in this bulletin are stated as concisely as possible in order that no one will be confused. If there is any doubt as to whether or not disease exists, write to the State Bee Inspector for assistance.

STATE LAW ON BEE DISEASES.

AN ACT *to prevent the introduction and spread in Illinois of foulbrood among bees, providing for the appointment of a State Inspector of Apiaries and prescribing his powers and duties.*

WHEREAS, The disease known as foulbrood exists to a very considerable extent in various portions of this State, which, if left to itself, will soon exterminate the honey-bees; and

WHEREAS, The work done by an individual beekeeper or by a State Inspector is useless so long as the official is not given authority to inspect, and, if need be, to destroy the disease when found; and

WHEREAS, There is a great loss to the beekeeper and fruit growers of the State each year by the devastating ravages of foulbrood;

SECTION 1. *Be it enacted by the People of the State of Illinois, represented in the General Assembly:* That the Governor shall appoint a State Inspector of Apiaries, who shall hold his office for the term of two years, and until his successor is appointed and qualified, and who may appoint one or more assistants, as needed, to carry on the inspection under his supervision. The Inspector of Apiaries shall receive for each day actually and necessarily spent in the performance of his duties the sum of four dollars to be paid upon bills of particulars certified to as correct by the said State Inspector of Apiaries, and approved by the Governor.

SEC. 2. It shall be the duty of every person maintaining or keeping any colony or colonies of bees to keep same free from the disease known as foulbrood and from other contagious diseases among bees. All beehives, bee fixtures or appurtenances, where foulbrood or other contagious or infectious disease among bees exist, are hereby declared to be nuisances to be abated as hereinafter prescribed. If the Inspector of Apiaries shall have reason to believe that any apiary is infected by foulbrood or other contagious disease, he shall have power to inspect, or cause to be inspected from time to time, such apiary, and for the purpose of such inspection he, or his assistants, are authorized during reasonable business hours to enter into or upon any farm or premises, or other building or place used for the purpose of propagating or nurturing bees. If said Inspector of Apiaries, or his assistants, shall find by inspection that any person, firm or corporation is maintaining a nuisance as described in this section, he shall notify in writing the owner or occupant of the premises containing the nuisance so disclosed of the fact that such nuisance exists. He shall include in such a notice a statement of the conditions constituting such nuisance, and order that the same be abated within a specified time, and a direction, written or

printed, pointing out the methods which shall be taken to abate the same. Such notice and order may be served personally or by depositing the same in the postoffice properly stamped, addressed to the owner or occupant of the land or premises upon which such nuisance exists, and the direction for treatments may consist of a printed circular, bulletin or report of the Inspector of Apiaries or an extract from same.

If the person so notified shall refuse or fail to abate said nuisance in the manner and in the time prescribed in said notice, the Inspector of Apiaries may cause such nuisance to be abated, and he shall certify to the owner or person in charge of the premises the cost of the abatement and if not paid to him within sixty days thereafter the same may be recovered, together with the costs of action, before any court in the State having competent jurisdiction.

In case notice and order served as aforesaid shall direct that any bees, hives, bee-fixtures or appurtenances shall be destroyed and the owner of such bees, hives, bee-fixtures or appurtenances shall consider himself aggrieved by said order, he shall have the privilege of appealing within three days of the receipt of the notice to the County Court of the county in which such property is situated. The appeal shall be made in like manner as appeals are taken to the County Court from judgments of justices of the peace. Written notice of said appeal served by mail upon the Inspector of Apairies shall operate to stay all proceedings until the decision of the County Court, which may, after investigating the matter, reverse, modify or affirm the order of the Inspector of Apiaries. Such decision shall then become the order of the Inspector of Apiaries, who shall serve the same as hereinbefore set forth and shall fix a time within which such decision must be carried out.

SEC. 2a. No person shall transport a colony of bees or used bee equipment, except a live queen and her attendant bees in a cage without comb or brood, from one county of this State to another county of this State, without a certificate from the Department of Agriculture, stating that it has, within sixty days before the date of shipment, inspected the colony or equipment and found it to be free from foulbrood.

SEC. 2b. No person shall transport a colony of bees or used bee equipment except a live queen and her attendant bees in a cage without comb or brood, into this State from a state or country having an inspector of apiaries or other officer charged with similar duties, without a certificate stating that the officer has, within sixty days before the date of shipment, inspected the colony or equipment and found it to be free from foulbrood.

No person shall transport a colony of bees or used bee equipment, except a live queen and her attendant bees in a cage without comb or brood, into this State from a state not having an inspector of apiaries or other officer charged with similar duties, unless the shipper or consignee has obtained from the Department of Agriculture, upon making a sufficient showing that the colony or equipment is free from foulbrood, a permit for the shipment into the State.

SEC. 3. The Inspector of Apiaries shall, on or before the second Monday in December of each calendar year, make a report to the Governor and also to the Illinois State Beekeepers' Association, stating the number of apiaries visited, the number of those diseased and treated,

the number of colonies of bees destroyed and the expense incurred in the performing of his duties.

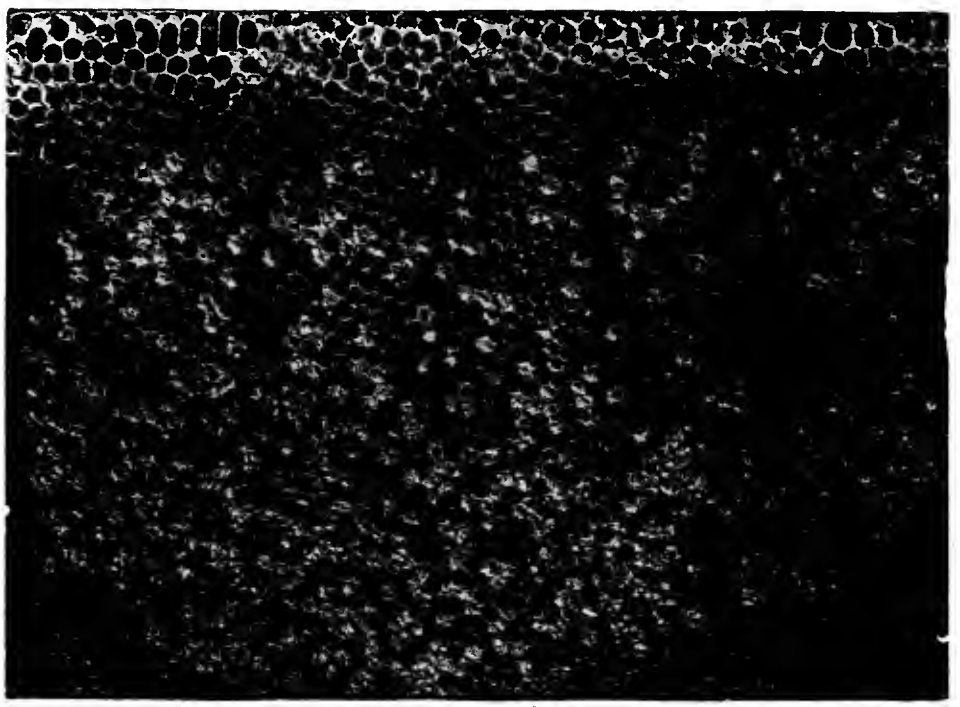
SEC. 4. Any owner of a diseased apiary or appliances taken therefrom, who shall sell, barter or give away any such apiary, appliance, queens or bees from such apiary, expose other bees to the danger of contracting such disease or refuse to allow the Department of Agriculture to inspect such apiary or appliances, and any person who shall violate the provisions of section 2a or section 2b of this Act, shall be fined not more than $100.00.

AMERICAN FOULBROOD.

Description.
(Bacillus larvae, White.)

The best description which can be given is that of Dr. E. F. Phillips, in Farmers' Bulletin 442, of the Department of Agriculture.

"American foulbrood usually shows itself in the larva, just about the time that it fills the cell and after it has ceased feeding and has begun pupation (changing from the grub condition to the winged insect.)



A comb of American Foulbrood.

At this time, it is sealed over in the comb (by the bees). The first indication of the infection is a slight brownish discoloration and the loss of the well-rounded appearance of the normal larva. At this stage the disease is not usually recognized by the beekeeper. The larva gradually sinks down in the cell and becomes darker in color and the posterior end lies against the bottom of the cell. By the time it has partially dried down and has become quite dark *(brown coffee colored)*, the most typical characteristic of this disease manifests itself. If a match, stick or tooth pick is inserted into the decaying mass and withdrawn, the larva-remains adhere to it and are drawn out in a thread, which sometimes extends for an inch or more before breaking. This ropiness is the chief

characteristic in diagnosing the disease. The larva continues to dry down and gradually loses its ropiness until it finally becomes merely a scale on the lower side wall and base of the cell. This scale adheres tightly to the cell and can be removed with difficulty from the cell wall. The scales can be observed when the comb is held with the top inclined toward the observer, so that a bright light strikes the lower side wall. A very characteristic and penetrating odor is noticeable in the decaying larva. This can be best likened to the *odor of heated glue.*

"The majority of the larvae which die of this disease are attacked after being sealed in the cells. The cappings are often entirely removed by the bees, but when they are left they usually become sunken and frequently perforated. As the healthy brood emerges, the comb shows the scattered sunken cappings covering dead larvae, giving a characteristic appearance.

"Pupae (the transforming grub, also called chrysalis) also may die of this disease, in which case they, too, dry down, become ropy and have the odor and color. The tongue frequently adheres to the upper side wall and often remains there even after the pupa has dried down to a scale."

Treatment.

Previous to treatment clip the queen's wings when everything has been provided, go to the diseased colony, remove the hive from its stand and put it about three or four feet back. Place a clean empty hive on the old stand with a flat board or flat cover half way over the empty hive body with a brick on it to keep the cover from falling off.

Now smoke the diseased colony just enough to keep them quiet and proceed to take out the frames and shake or brush off the bees in the open half of the empty body, putting the combs in another hive body that you have placed handy to receive them, keeping them covered.

After you have all the bees in the newly prepared hive, close the hive with the board that is already over half of it. Leave the colony two days, then at the end of this time raise the board that is used as a cover about six inches and bring it down on the hive with a quick slam. This will dislodge the bees that have clustered on the under side of the cover or board. Have a hive in close reach with frames and full sheets of foundation, quickly put this prepared hive over the one that has the bees in, the bees will go up in this hive, and in the morning lift the top hive off and place it on the bottom board, if any bees are on the sides of the hive body brush them in front of the colony and your treatment is complete.

Now take the diseased combs and burn them. If any comb has been built on the board or cover, this also must be burned. If the inspector finds a colony that is too badly diseased to warrant treatment he may order same burned.

EUROPEAN FOULBROOD.

Description.

European foulbrood usually attacks the larva at an earlier stage of its development than American foulbrood and while it is still curled at the base of the cell. A small percentage of larvae die after capping, but sometimes quite young larvae are attacked. Sunken and perforated cappings may exist as in American foulbrood. The earliest indication of the disease is a slight yellow or gray discoloration and uneasy movement of the larva in the cell. It loses its well-rounded apaque appearance and becomes slightly translucent so that the trachae may become prominent giving the larva a clear segmented appearance. Later the color changes to a decided yellow or gray and the translucency is lost. The yellow color is the chief characteristic of this disease. The dead larva appears as a moist, somewhat collapsed mass, giving the appearance of being melted. The larva finally dries in a grayish-brown scale against the base of the cell, or a shapeless mass on the lower side wall. Very few scales are black. The scales are not adhesive, but easily removed, and the bees carry out a great many of them. Decaying larvae which have died of this disease are usually not ropy as in American foulbrood, but a slight ropiness is sometimes observed. Sometimes a sour odor is present, which reminds one of yeast fermentation.

Treatment.

As soon as the disease shows, kill the old queen, and if the colony is common brown or black, keep all queen cells cut out. Fifteen days after you kill the queen, introduce a young laying Italian queen. If the colony be of good Italian stock, allow the colony to rear a queen. Keep the colony *strong;* a weak colony will not rid themselves of disease.

OLD BOX HIVES.

Remove a portion of the top so you can blow smoke in, turn the hive upside down, and place a box as nearly the size of the old hive as you can get, on top. Smoke into the opening that you have made and drum on the box, until you have all the bees out of the old hive into the box on top.

Place the box containing the bees where the old hive formerly stood. Saturate the old hive and combs with kerosene and destroy as instructed in American foulbrood.

In two or three days dump the bees from the box into a hive body which is placed on the stand where the box was and fill the hive body

with frames of foundation and place the cover on your hive. Destroy all combs that were built in the box.

If there is no disease in the old box hive, the bees may be run on full sheets of foundation at once.

SUGGESTIONS.

By adhering to the following suggestions and avoiding the "Don'ts" the beekeeper may save himself much trouble and worry as well as financial loss.

Don't use frame hives without foundation.

Don't use box hives, bees cannot be controlled in them.

Don't allow robbing in your apiary.

Don't waste your time trying to save a colony with only a handful of bees.

Don't buy everything you see advertised in bee papers, as they may not all fit your conditions.

Leave only a small entrance during spring, until your colonies show by clustering at entrance that a larger opening is necessary.

Keep all colonies strong, even should you have to resort to feeding in order to have the colony breed up. Feed granulated sugar syrup, a pound of sugar to a pound of water.

Use full sheets of foundation in your brood frames.

Keep a good strain of Italian bees.

Read the bee journals. The price of a good bee journal is money well spent.

If you winter your bees out of doors, give them adequate packing, using forest leaves or other absorbents for this purpose. Place at least six inches of leaves over the brood frames and at least four inches of leaves around the hives, except the front, held in place by wire netting.

Black bees and low-grade hybrids are the most susceptible to European foulbrood. Keep only pure Italian bees.

Make an effort to produce more honey this year than ever before.

(Reprint Circular No. 261, Illinois Department of Agriculture.)

FORMATION OF THE ILLINOIS STATE BEEKEEPERS' ASSOCIATION.

SPRINGFIELD, ILL., *February 26, 1891.*

The Capitol Beekeepers' Association was called to order by President P. J. England.

Previous notice having been given that an effort would be made to form a State Association, and there being present beekeepers from different parts of the State, by motion, a recess was taken in order to form such an association.

P. J. England was chosen temporary chairman and C. E. Yocum temporary secretary. On motion, the Chair appointed Thos. G. Newman, C. P. Dadant and Hon. J. M. Hambaugh a Committee on Constitution.

Col. Charles F. Mills addressed the meeting on the needs of a State association and stated that it was his opinion that the beekeepers should have a liberal appropriation for a State Apiarian Exhibit at the World's Columbia Exposition.

A motion to adjourn 'till 1:30 p. m. prevailed.

AFTERNOON SESSION.

The Committee on Constitution reported a form for same which, on motion, was read by the Secretary, by sections serially.

Geo. F. Robbins moved to substitute the word "shall" for "may" in the last clause of Section 1, Article III. This led to a very animated discussion, and the motion was lost.

J. A. Stone moved to amend the above-named section by striking out the word "ladies" and all that followed of the same section, which motion led to further discussion, and motion finally prevailed.

Section 2, Article II, relating to a quorum, was on motion, entirely stricken out.

Mr. Robbins moved to amend Article V by adding the words "Thirty days' notice having been given to each member." Prevailed.

Thos. G. Newman moved to adopt the Constitution, so amended, as a whole. Which motion prevailed.

(See Constitution).

J. A. Stone moved that the Chair appoint a Nominating Committee of three on permanent organization. Prevailed.

Chair appointed as such committee, Col. Charles F. Mills, Hon. J. M. Hambaugh and C. P. Dadant.

Committee retired and in a few minutes returned, submitting the following named persons as candidates for their respective offices:

For President—P. J. England, Fancy Prairie.

For Vice-Presidents—Mrs. L. Harrison, Peoria; C. P. Dadant, Hamilton; W. T. F. Petty, Pittsfield; Hon. J. M. Hambaugh, Spring; Dr. C. C. Miller, Marengo.

Secretary—Jas. A. Stone, Bradfordton.

Treasurer—A. N. Draper, Upper Alton.

Mr. Black moved the adoption of the report of the Committee on Nominations. The motion prevailed, and the officers as named by the committee were declared elected for the ensuing year.

Hon. J. M. Hambaugh moved that Mr. Thos. G. Newman, Editor, American Bee Journal, of Chicago, be made the first honorary member of the association. Prevailed.

At this point, Col. Chas. F. Mills said:

"Mr. Chairman, I want to be the first one to pay my dollar for membership," at the same time suiting his action to his words, and others followed his example, as follows:

CHARTER MEMBERS.

Col. Charles F. Mills, Springfield.
Hon. J. M. Hambaugh, Spring.
Hon. J. S. Lyman, Farmingdale.
C. P. Dadant, Hamilton.
Chas. Dadant, Hamilton.
A. N. Draper, Upper Alton.
S. N. Black, Clayton.
Aaron Coppin, Wenona.
Geo. F. Robbins, Mechanicsburg.
J. W. Yocum, Williamsville.
Thos. S. Wallace, Clayton.
A. J. England, Fancy Prairie.
P. J. England, Fancy Prairie.
C. E. Yocum, Sherman.
Jas. A. Stone, Bradfordton.

HONORARY MEMBERS.

1891—Thos. G. Newman, Editor American Bee Journal, Chicago.
1892—Frank Benton, Agricultural Dept., Washington, D. C.
Rev. W. F. Clarke, Guelph, Ontario.
1893—Rev. A. H. Bates, Springfield.
Col. Chas. F. Mills, Springfield.
1894—Geo. W. York, Chicago.
(Now Editor Bees and Honey, Alhambra, California.)
A. I. Root, Medina, Ohio.
W. Z. Hutchinson, Flint, Michigan.
E. R. Root, Medina, Ohio.
C. P. Dadant, Hamilton, Illinois.
Dr. C. C. Miller, Marengo, Illinois.
E. D. Townsend, Altmont, Michigan.
1911—Dr. E. F. Phillips, Cornell University, Ithaca, N. Y.
Dr. G. Bohrer.
Miss Lillian M. Stewart.
1919—Jas. A. Stone, Farmingdale, Illinois.
Aaron Coppin, Wenona, Illinois.
1928—Dr. A. C. Baxter, Springfield.
A. L. Kildow, Putnam.

Charter member deceased 1931—
A. N. Draper, Upper Alton.

Charter members living 1932—
C. P. Dadant, Hamilton, Illinois.
Jas. A. Stone, Farmingdale, Illinois.

STATE CHARTER.
STATE OF ILLINOIS—DEPARTMENT OF STATE.

Isaac N. Pearson. Secretary of State.

To all to whom these presents shall come—GREETINGS:

Whereas, A certificate duly signed and acknowledged having been filed in the office of the Secretary of State on the 27th day of February, A. D. 1891, for the organization of the Illinois State Beekeepers' Association, under and in accordance with the provisions of "An Act Concerning Corporations, approved April 18, 1872, and in force July 1, 1872, and all acts amendatory thereof, a copy of which certificate is hereunto attached.

Now, Therefore, I, Isaac N. Pearson, Secretary of State of the State of Illinois, by virtue of the powers and duties vested in me by law, do hereby certify that the said, The Illinois State Beekeepers' Association, is a legally organized corporation under the laws of the State.

In Testimony Whereof, I hereunto set my hand and cause to be affixed the great seal of State.

Done at the city of Springfield, this 27th day of February, in the year of our Lord one thousand eight hundred and ninety-one, and the Independence of the United States the one hundred and fifteenth.

[SEAL] I. N. PEARSON, *Secretary of State.*

STATE OF ILLINOIS, } ss.
County of Sangamon }

To Isaac N. Pearson, Secretary of State:

We, the undersigned, Perry J. England, Jas. A. Stone, and Albert N. Draper, citizens of the United States, propose to form a corporation, under an act of the General Assembly of the State of Illinois, entitled, "An Act Concerning Corporations," approved April 18, 1872, and all acts amendatory thereof; and for the purpose of such organizations, we hereby state as follows to-wit:

1. The name of such corporation is, The Illinois State Beekeepers' Association.

2. The object for which it is formed is to promote the general interests of the pursuit of bee-culture.

3. The management of the aforesaid Association shall be vested in a board of three Directors, who are to be elected annually.

4. The following persons are hereby selected as the Directors, to control and manage said corporation for the first year of its corporate existence, viz: Perry J. England, Jas. A. Stone, and Albert N. Draper.

5. The location is in Springfield, in the county of Sangamon, State of Illinois.

(Signed) PERRY J. ENGLAND,
JAS. A. STONE,
ALBERT N. DRAPER.

STATE OF ILLINOIS } ss.
Sangamon County }

I, S. Mendenhall, a notary public in and for the county and State aforesaid, do hereby certify that on this 26th day of February, A. D. 1891, personally appeared before me, Perry J. England, James A. Stone, and Albert N. Draper to me personally known to be the same persons who executed the foregoing certificate, and severally acknowledged that they had executed the same for the purpose therein set forth.

In witness whereof, I have hereunto set my hand and seal the day and year above written.

[SEAL] S. MENDENHALL, *Notary Public.*

CONSTITUTION AND BY-LAWS OF THE ILLINOIS STATE BEEKEEPERS' ASSOCIATION.

CONSTITUTION.

ADOPTED FEBRUARY 26, 1891.

ARTICLE I.

This organization shall be known as The Illinois State Beekeepers' Association, and its principal place of business shall be at Springfield, Illinois.

ARTICLE II—OBJECT.

Its object shall be to promote the general interests of the pursuit of bee-culture.

ARTICLE III—MEMBERSHIP.

SECTION 1. Any person interested in apiculture may become a member upon the payment to the Secretary of an annual fee of one dollar and fifty cents ($1.50). (Amended to $1.75, 1919; amended to $1.00 at annual meeting December, 1928). And any affiliating association, as a body may become members on payment of an aggregate fee of fifty cents (50c) per member, as amended November, 1910. (Associations must have affiliated 10 or more members in one of two previous years.)

SEC. 2. Any person may become honorary member by receiving a majority vote at any regular meeting.

ARTICLE IV—OFFICERS.

SECTION 1. The officers of this association shall be, President, Vice-President, Secretary and Treasurer. (Since amended to include 5 regional Vice-Presidents.) Their terms of office shall be for one year, or until their successors are elected and qualified.

SEC. 2. The President, Secretary and Treasurer shall constitute the Executive Committee.

SEC. 3. Vacancies in office—by death, resignation and otherwise — shall be filled by the Executive Committee until the next annual meeting.

ARTICLE V—AMENDMENTS.

This Constitution shall be amended at any annual meeting by a two-thirds vote of all the members present—thirty days' notice having been given to each member of the association.

BY-LAWS.

ARTICLE I.

The officers of the association shall be elected by ballot and by a majority vote.

ARTICLE II.

It shall be the duty of the President to call and preserve order at all meetings of this association; to call for all reports of officers and committees; to put to vote all motions regularly seconded; to count the vote at all elections, and declare the results; to decide upon all questions of order, and to deliver an address at each annual meeting.

ARTICLE III.

The Vice Presidents shall be numbered, respectively, First, Second, Third, Fourth, and Fifth, and it shall be the duty of one of them, in his respective order, to preside in the absence of the President.

ARTICLE IV.

SECTION 1. It shall be the duty of the Secretary to report all proceedings of the association, and to record the same, when approved, in the Secretary's book; to conduct all correspondence of the association, and to file and preserve all papers belonging to the same; to receive the annual dues and pay them over to the Treasurer, taking his receipt for the same; to take and record the name and address of every member of the association; to cause the Constitution and By-Laws to be printed in appropriate form and in such quantities as may be directed by the Executive Committee from time to time, and see that each member is provided with a copy thereof; to make out and publish annually, as far as practicable, statistical tables showing the number of colonies owned in the spring and fall, and the amount of honey and wax produced by each member, together with such other information as may be deemed important, or be directed by the Executive Committee; and to give notice of all meetings of the association in the leading papers of the State, and in the bee journals at least four weeks prior to the time of such meeting.

SEC. 2. The Secretary shall be allowed a reasonable compensation for his services, and to appoint an assistant Secretary if deemed necessary.

ARTICLE V.

It shall be the duty of the Treasurer to take charge of all funds of the association, and to pay them out upon the order of the Executive Committee, taking a receipt for the same; and to render a report of all receipts and expenditures at each annual meeting.

ARTICLE VI.

It shall be the duty of the Executive Committee to select subjects for discussion and appoint members to deliver addresses or read essays, and to transact all interim business.

ARTICLE VII.

The meeting of the association shall be, as far as practicable, governed by the following order of business:

Call to order.
Reading minutes of last meeting.
President's address.
Secretary's report.
Treasurer's report.
Reports of committees.
Unfinished business.
Reception of members and collection.
Miscellaneous business.
Election and installation of officers.
Discussion.
Adjournment.

ARTICLE VIII.

These By-Laws may be amended by a two-thirds vote of all the members present at any annual meeting.

C. E. YOCUM,
AARON COPPIN,
GEO. F. ROBBINS,

BEEKEEPERS' ASSOCIATION.

THE ORIGINAL BILL.

§ 1. Appropriates $1,000 per annum—proviso. § 2. How drawn. § 3. Annual report.

AN ACT *making an appropriation for the Illinois State Beekeepers' Association.*

WHEREAS, The members of the Illinois State Beekeepers' Association have for years given much time and labor without compensation in the endeavor to promote the interests of the beekeepers of the State; and,

WHEREAS, The importance of the industry to the farmers and fruitgrowers of the State warrants the expenditure of a reasonable sum for the holding of annual meetings, the publication of reports and papers containing practical information concerning beekeeping, therefore, to sustain the same and enable this organization to defray the expenses of annual meetings, publishing reports, suppressing foulbrood among bees in the State, and promote the industry in Illinois;

SECTION 1. *Be it enacted by the People of the State of Illinois, represented in the General Assembly:* That there be and is hereby appropriated for the use of the Illinois State Beekeepers' Association the sum of one thousand dollars ($1,000) per annum for the year 1917-1918, for the purpose of advancing the growth and developing the interests of the beekeepers of Illinois, said sum to be expended under the direction of the Illinois State Beekeepers' Association for the purpose of paying the expenses of holding annual meetings, publishing the proceedings of said meetings, suppressing foulbrood among bees in Illinois, etc.

Provided, however, That no officer or officers of the Illinois State Beekeepers' Association shall be entitled to receive any moneys compensation whatever for any services rendered for the same, out of this fund.

SEC. 2. That on the order of the President, countersigned by the Secretary of the Illinois State Beekeepers' Association, and approved by the Governor, the Auditor of Public Accounts shall draw his warrant on the Treasurer of the State of Illinois in favor of the treasury of the Illinois State Beekeepers' Association for the sum herein appropriated.

SEC. 3. It shall be the duty of the Treasurer of the Illinois State Beekeepers' Association to pay out of said appropriation, on itemized and receipted vouchers, such sums as may be authorized by vote of said organization on the order of the President countersigned by the Secretary, and make annual report to the Governor of all such expenditures, as provided by law.

Itemized in the Omnibus Bill as follows:

For shorthand reporting	$200.00
For postage and stationery	50.00
For printing	550.00
Expense of meetings	200.00
Total amount of the appropriation	$1,000.00

The Assembly ruled that this is not to be paid in LUMP, but drawn on itemized accounts.

GENERAL INFORMATION FOR BEEKEEPERS.

Bee Journals Published in the United States.

	Regular Subscription.	To Assn. Members.
American Bee Journal, Hamilton, Illinois...	$1.00	50c
Beekeepers' Item, Box 838, San Antonio, Texas	1.00	50c
Bees and Honey, 236 West Valley Boulevard, Alhambra, California	1.00	75c
Gleanings in Bee Culture, Medina, Ohio....	1.00 (2 yrs.)	50c (1 yr.) 90c (2 yrs.)

(The publishers will furnish sample copies upon request.)

Several trade and state associations publish journals or circulars of information for their membership as follows:

The American Honey Producers' League Annual Report—Official organ of The American Honey Producers' League. (With membership at $1.00 per year, otherwise 75c per year.)

Wisconsin Beekeeping.

Monthly bulletin Illinois State Beekeepers' Association. (50c to non-members.)

Beecause. 12c. G. B. Lewis Co., Watertown, Wisconsin.

Free Literature and Circulars on Bees and Honey.

Bureau of Entomology, U. S. Department of Agriculture.

Most state experiment stations have bulletins or mimeographed materials.

A. I. Root Co., Medina, Ohio. The Bee Hive.

Kellogg Co., Battle Creek, Michigan.

Recipe pamphlets: Do you like Honey? Cooking with Honey. Do you use Honey?

All-Bran poster, featuring a jar of honey.

Full page advertisement, featuring honey.

Recipe labels for honey containers.

Recipe cards.

Manufacturers of Bee Supplies.

The names of the leading bee supply manufacturers can be obtained by reading the advertisements in the bee journals. They will furnish catalogues upon request.

Shippers of Bees and Queens.

Consult the bee journals. The person or firm that remains in business over a period of years is usually the most reliable. When in doubt as to the reliability of any particular advertiser, write to the editors for definite information.

Books on Bees and Beekeeping.

	PRICE.
Atkins and Hawkins—How to Succeed with Bees	$ .59
Campbell, C. P.—The Law of the Honey Bee	1.00
Dadant, C. P.—First Lessons in Beekeeping	1.00
The Dadant System of Beekeeping	1.00
New Observations Upon Bees—By Huber	3.00
Dadant, M. G.—Out Apiaries	1.00
Doolittle, G. M.—Scientific Queen Rearing	.50
Hawkins, K.—Beekeeping in the South	1.00
Langstroth & Dadant—The Honey-Bee	2.50
Lovell, J. H.—Honey Plants of North America	2.50
Miller, C. C.—Fifty Years Among the Bees	1.50
1,000 Answers to Beekeeping Questions	1.25
Pellet, F. C.—American Honey Plants	3.00
Productive Beekeeping	3.00
Practical Queen Rearing	1.00
Beginners' Bee Book	1.50
Phillips, E. F.—Beekeeping	4.00
Quinby, M.—Mysteries of Beekeeping Explained	1.00
Rowe, H. G.—Starting Right With Bees	.75
Smith, Jay—Queen Rearing Simplified	1.25
Snodgrass—Anatomy and Physiology of the Honey Bee	3.50
Root—A B C & X Y Z of Beekeeping	2.50

Any of this list of books can be purchased from the bee supply manufacturers or the beekeeping journals. Every beekeeper should read several of these books.

Advantages of Membership in State or County Beekeeping Associations.

1. Education on proper methods of managing bees which means bigger crops of quality honey marketed at quality prices.
2. United action and cooperation in the eradication of bee diseases.
3. Reduced rates on subscription to bee journals and free subscription to the association news.
4. Savings on bee supplies by ordering collectively.
5. Uniform prices for honey through cooperative marketing.
6. Acquaintance and friendship of brother beekeepers, developing a spirit of mutual helpfulness.

Diseases of Bees and Apiary Inspection.

Illinois State Apiary Inspection—Mr. A. L. Kildow, Putnam, Illinois, Chief Inspector. State Law on Bee Diseases—Circular No. 261.

CODE OF RULES AND STANDARDS FOR GRADING APIARIAN EXHIBITS AT FAIRS AS ADOPTED BY ILLINOIS STATE BEEKEEPERS' ASSOCIATION.

Comb Honey.

Rule 1. Comb honey shall be marked on a scale of 100, as follows:

Quantity	40	Style of display	20
Quality	40		

Rule 2. Points of quality should be:

Variety	5	Straightness of comb	5
Clearness of capping	10	Uniformity	5
Completeness of capping	5	Style of section	5
Completeness of filling	5		

Remarks: 1. By variety is meant different kinds, with regard to the sources from which the honey is gathered, which adds much interest to an exhibit.

2. By clearness of capping is meant freedom from travel stain and a water soaked appearance. This point is marked a little high, because it is a most important one. There is no better test of the quality of comb honey than the appearance of the cappings. If honey is taken off at the proper time, and cared for as it should be, so as to preserve its original clear color, body and flavor will take care of themselves, for excellence in the last two points always accompanies excellence in the first. Clover and basswood honey should be white; heartsease, a dull white tinged with yellow; and Spanish needle, a bright yellow.

3. By uniformity is meant closeness of resemblance in the sections composing the exhibit.

4. By style is meant neatness of the sections, freedom from propolis, etc.

5. Honey so arranged as to show every section should score the highest in style of display, and everything that may add to the tastiness and attractiveness of an exhibit should be considered.

Extracted Honey.

Rule 1. Extracted honey should be marked on a scale of 100, as follows:

Quantity	40	Style and display	15
Quality	45		

Rule 2. Points of quality should be:

Variety	10	Style of package	10
Clearness of color	5	Variety of package	5
Body	5	Finish	5
Flavor	5		

Remarks: 1. Light clover honey pouring out of a vessel is a very light straw color; Spanish needle, a golden hue, and dark clover honey, a dull amber.

2. Style of package is rated a little high, not only because in that consists the principal beauty of an exhibit of extracted honey, but also because it involves the best package for marketing. We want to show honey in the best shape for the retail trade, and that, in this case, means the most attractive style for exhibition. Glass packages should be given the preference

over tin; flint glass over green, and smaller vessels over larger, provided the latter run over one or two pounds.

3. By variety of package is meant chiefly different sizes; but small pails for retailing, and, in addition, cans or kegs (not too large) for whole-saleing may be considered. In the former case, pails painted in assorted colors, and lettered "Pure Honey," should be given the preference.

4. By finish is meant capping, labeling, etc.

5. Less depends upon the manner of arranging an exhibit of extracted than of comb honey, and for that reason, as well as to give a higher number of points to style of package, a smaller scale is allowed for style of display.

Samples of Comb and Extracted Honey.

Rule 1. Single cases of comb honey, entered as such for separate premiums, should be judged by substantially the same rules as those given for a display of comb honey, and samples of extracted, by those governing displays of extracted honey.

Rule 2. Samples of comb or extracted honey, as above, may be considered as part of the general display in their respective departments.

Granulated Honey.

Rule 1. Candied or granulated honey should be judged by the rules for extracted honey, except as below.

Rule 2. Points of quality should be:

Variety	10	Style of package	10
Fineness of grain	5	Variety of package	5
Color	5	Finish	5
Flavor	5		

Rule 3. An exhibit of granulated honey may be entered or considered as part of a display of extracted honey.

Nuclei of Bees.

Rule. Bees in observation hives should be marked on a scale of 100, as follows:

Color and markings	30	Quietness	5
Size of bees	30	Style of comb	5
Brood	10	Style of hive	10
Queen	10		

Remarks: 1. Bees should be exhibited only in the form of single frame nuclei, in hives or cages with glass sides.

2. Italian bees should show three or more bands, ranging from leather color to golden or light yellow.

3. The markings of other races should be those claimed for those races in their purity.

4. A nucleus from which the queen is omitted should score zero on that point.

5. The largest quantity of brood in all stages or nearest to that should score the highest in that respect.

6. The straightest, smoothest and most complete comb with the most honey consistent with the most brood, should score the highest in that respect.

7. That hive which is neatest and best made and shows the bees, etc., to the best advantage should score the highest.

Queen Bees.

Rule. Queen bees in cages should be marked on a scale of 100, as follows:

Quantity	40	Quality and variety	40
Style of caging and display	20		

Remarks: 1. The best in quality consistent with variety should score the highest. A preponderance of Italian queens should overweigh a preponderance of black ones, or, perhaps, of any other race or strain; but sample queens of any or all varieties should be duly considered. Under the head of quality should also be considered the attendant bees. There should be about a dozen with each queen.

2. Neatness and finish of cages should receive due consideration, but the principal points in style are to make and arrange the cages so as to show the inmates to the best advantage.

Beeswax.

Rule. Beeswax should be marked on a scale of 100, as follows:

Quantity	40	Quality	40
Style of display	20		

Remarks: 1. Pale, clear, yellow specimens should score the highest, and the darker grades should come next in order.

2. By style is meant chiefly the forms in which the wax is molded and put up for exhibition. Thin cakes or small pieces are more desirable in the retail trade than larger ones. Some attention may be given to novelty and variety.

MEMBERS OF ILLINOIS STATE BEEKEEPERS' ASSOCIATION.*

Aavang, Elmer, R. R. 3, Woodstock.
Adams, Ed., Strawn.
Aigley, Dr. J. E., 58 E. Fort Street, Farmington.
Albright, Mrs. J. W., Dalton City.
Allaman, Beulah, 702 E. Archer Avenue, Monmouth.
Allen, F. O., Stockland.
Allen, Otis, Harrisburg.
Allen, Stephen, Stanford.
Allen, Tom, Coulterville.
Allgren, C. E., Bishop Hill.
Ammon, Henry, Galena.
Amos, F. A., 1328 E. Main St., Decatur.
Anderson, A. A., 223 N. Washington Street, Kewanee.
Anderson, C. F., R. R. 5, Mt. Vernon.
Anderson, C. J., Lilly Lake.
Anderson, C. J., R. R. 2, Box 102, Morris.
Anderson, F. W. F., 239 Payson Street, Kewanee.
Anderson, R. M., Home Ridge Farm, Jerseyville.
Annear, Roy, Mulkeytown.
Applegate, J. F., 609 W. Beardsley Avenue, Champaign.
Ashley, W. C., Yorkville.
Atkinson, Robert R., Port Byron.
Attig, Fred, Ashton.
Auftkamp, Paul, R. R., Chapin.
Augenstein, A. A., R. R. 2, Dakota.
Bacle, Louis, Box 235, Norwood Park.
Bacmeister, Wm., Toulon.
Bailey, Carl M., R. R. 7, Decatur.
Baker, Earl, Genoa.
Ball, Fred, 112 Willard Street, Kewanee.
Bangs, E. H., 168 Addison Road, Riverside.
Baptist, Geo. T., Shelbyville.
Barr, H. I. & Son, Rock City.
Barthoff, R. J., Richmond.
Barton, J. R., 2706 W. Locust Street, Eldorado.
Batter, E. W., R. F. D. 3, Decatur.
Bauch, E. E., Freeport.
Baumgartner, E. C., R. R. 1, Walnut.
Baxter, Dr. A. C., Myers Office Building, Springfield (Honorary Member).
Baxter, E. J., Nauvoo.
Bean, Reginald, 1409 Forest Avenue, Mt. Vernon.
Bearden, Joseph H., 1014 N. Snodgrass Street, Taylorville.
Bearman, H. D., R. R. 2, Mt. Morris.
Bedoes, Tom, 2202 School, Rockford.
Beese, W. C., 211 Ellis Street, Peoria.
Bell, Alvin, Ridgway.
Bell, B. F., Box 56, Kingston Mines.
Bell, Chas. H., Scales Mound.
Bell, Mrs. Paradine, Box 56, Kingston Mines.
Bellatti, Fred F., R. R. 1, Mt. Pulaski.
Belt, F. R., R. R. 7, Canton.
Benson, Thorston, R. R. 1, Crystal Lake.
Bentz, Leo A., R. R. 4, Woodstock.
Bergschneider, Leonard, New Berlin.
Bergstrom, Arthur, Aledo.
Biegel, Wm., R. R. 3, Barrington.
Bielby, Joseph E., R. R. 2, LaGrange.
Binder, L. F., Harvard.
Black, H. O., R. R. 2, Lewistown.
Blake, M. F., Mt. Morris.
Blanchard, R. R., 508 First National Bank Bldg., Springfield.
Blocher, D. J., Pearl City.
Bloner, Wm., Cary.
Boal, A. D., 1218 Ross Court, Downers Grove.
Boberg, Ed., Cambridge.
Bodenschatz, Adam J., Box 272, Lemont.
Boedeker, F. A., 336 W. 118th Street, Chicago.
Boning, R. B., Toulon.
Bonsell, George, R. R. 2, McHenry.
Bowers, Glenn, 517 Fairfield Avenue, Elmhurst.
Braner, Chester, Jacksonville.
Breagle, Clint, Equality.
Brelsford, W. H., Box 123, Kenney.

* This membership list contains also the names of members who paid dues in 1931 which expired in 1932 but membership was not paid for the full year of 1932.

Brennecha, Ed., R. R. 2, Richmond.
Brigham, Wm. B., 1301 N. East Street, Bloomington.
Bright, John, R. R. 1, Normal.
Brock, J. L., Bethany.
Brosius, Wm., Galva.
Brott, Walter H., R. R. 2, Woodstock.
Brown, C. W., 118 E. Bond Street, Monticello.
Brown, Chas. W., Aledo.
Brown, E. W., Box 117, Willow Springs.
Brown, Lynch, Scott County, Monmouth.
Brown, Will A., Box 11, Waddams Grove.
Bryan, H. J., Market Street, Normal.
Bruns Seed Store, Davenport, Iowa.
Buckley, F. C., Libertyville.
Bunker, D. A., LaFox.
Burdzilduskas, Joe, N. 4, Johns Street, Pana.
Burrows, Wayne, 725 Island Avenue, Rockford.
Burtis, John C., El Paso.
Cable, Geo. S., El Paso.
Caldwell, L. R., Nashville.
Cale, G. H., Hamilton.
Campbell, Charles, 6147 S. McVickers Avenue, Chicago.
Carlson, Chas. J., Woodhull.
Carlson, P. A., Galva.
Carmichael, W. Philip, Stanford.
Carson, Samuel W., Harvard.
Cecil, Clarence, Atkinson.
Chambers, J. O., Pierson Station.
Chesterman, P. L., Tower Hill.
Clark, Frank, Ridott, Illinois.
Clark, Gordon, R. R. 3, Woodstock.
Clark, Warren S., 1352 N. Broadway, Decatur.
Claude, J., R. R. 1, Sandwich.
Clausen, R., Lake Forest.
Claussen, S. S., Oregon.
Clete-Henton, J., Shelbyville.
Cleveland, Frank, Prophetstown.
Coggins, Paul, Zion.
Cole, Fred, Hillsdale.
Colegrove, Carroll S., East Moline.
Colts, H. C., R. R. 4, Harvard.
Comb, Dr. William Brimble, Carmi.
Concidine, Roy, 519 DeKalb Avenue, DeKalb.
Conner, John, R. R. 2, North Caldwell, N. J.
Cook, C. F., Macon.
Cook, Clifton, R. R. 5, Martinsville.
Cook, E. T., Mundelein.
Coombs, Jas. F., Shagbark Lake, Des Plaines.
Coon, Edson, Cambridge.
Cooper, A. C., Wyoming.
Cooper, Mrs. Wm., Butler.
Copenheaven, W. E., Mansfield.
Corliss, W. B., Chenoa.
Coss, Ralph, Harvard.
Cowen, W. H., 1022 Ontario Street, Oak Park.
Crane, Bert, R. R. 2, LaSalle.
Crane, Harry, R. R. 1, Gardner.
Craske, W., 2148 W. One Hundred Seventh Place, Chicago.
Craver, J. A., McHenry.
Creasey, Chas., Neponset.
Crowe, W. E., Gibson City.
Crutchley, W. E., R. R. 1, McLean.
Cullison, J. E., Shelbyville.
Cunningham, C. F., 1636 E. William Street, Decatur.
Curphy, John, Onarga.
Cushman, Samuel, Room 506, 6 E. Lake Street, Chicago.
Dadant, C. P., Hamilton.
Dadant, H. C., Hamilton.
Dadant, L. C., Hamilton.
Dadant, M. G., Hamilton.
Dal Ziel, R., R. R. 2, Ingleside.
Davidson, A. L. Shelbyville.
Davis, Frank, Homer.
Davis, Palmer, Homer.
Dean, L. A., R. R. 1, Big Rock.
Decker, H. U., Aledo.
DeMeyer, A., R. R. 1, Libertyville.
Denhart, Herman, R. R. 3, St. Joseph.
Dennis, Ed., Casner.
De Pew, S. H., Zion.
Deshayes, A. L., 910 S. Anderson, Urbana.
DeSort, Frank, 1308 Ottawa Street, Lincoln.
Devillez, Fred and W. A., Harrisburg.
Dickey, Ralph V., DeWitt.
Dickison, Mr. F., R. R. 1, Libertyville.
Dicus, Dr. J. B., 159 N. State Street, Chicago.
Dineen, J., St. Nicholas Hotel, Springfield.
Dirkson, R. W., 225 W. Cleveland Street, Freeport.
Doermann, A. W. T., 2554 W. Grove Street, Blue Island.
Dolan, Karl, Allenville.
Donovan, Robert, O. S. B., care of St. Bede College, Peru.
Dorais, E. J., 510 N. Ardmore Avenue, Villa Park.
Dorland, W. S., 511 N. School Street, Normal.
Dorwart, E. C., R. R. 1, Itasca.
Doty, Oamer M., R. R. 6, Decatur.
Douglas, W. F., R. R. 3, Woodstock.
Dowdy, John S. Atlanta.
Doyle, Mrs. Rose, R. R. 1, Gurnee.

Drehmer, Willis, Osco.
Dressel, F. L., Jerseyville.
Dringenberg, Ed., Glasford.
Duax, C. L., 3414 S. Western Avenue, Chicago.
Duckwall, W. G., R. R. 2, Jacksonville.
Dueringer, Chester E., Gibson City.
Duerrstein, C. W., R. R. 1, Galena.
Dulleck, Frank, Spring Grove.
Dunn, H. L., Onarga.
Durkie, Frank L., R. R. 6, Ottawa.
Dyar, H. L., Eureka.
Dyck, Herman F., 112 S. Chase Street, Wheaton.
Earl, Ethel H., Dalton City.
Earle, C. F., Dalton City.
Ebersol, John, Scales Mound.
Eckhardt, Frank, Dalton City.
Egbert, C. T., Toulon.
Egbert, Will C., Aledo.
Eich, George, 711½ N. Broadway Street, Joliet.
Eichmeier, Mrs. Martha, R. R. 7, Princeton.
Eisenbise, Ira B., Lanark.
Eiserman, C. R., Roundout.
Eldred, M. G., R. R. 1, Bartlett.
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